National Library
of Canada

Acquisitions and
Bibliographic Services Branch

395 Wellington Street
Ottawa, Ontario
K1A 0N4

Bibliothèque nationale
du Canada

Direction des acquisitions et
des services bibliographiques

395, rue Wellington
Ottawa (Ontario)
K1A 0N4

Your file Votre référence

Our file Notre référence

NOTICE

The quality of this microform is heavily dependent upon the quality of the original thesis submitted for microfilming. Every effort has been made to ensure the highest quality of reproduction possible.

If pages are missing, contact the university which granted the degree.

Some pages may have indistinct print especially if the original pages were typed with a poor typewriter ribbon or if the university sent us an inferior photocopy.

Reproduction in full or in part of this microform is governed by the Canadian Copyright Act, R.S.C. 1970, c. C-30, and subsequent amendments.

AVIS

La qualité de cette microforme dépend grandement de la qualité de la thèse soumise au microfilmage. Nous avons tout fait pour assurer une qualité supérieure de reproduction.

S'il manque des pages, veuillez communiquer avec l'université qui a conféré le grade.

La qualité d'impression de certaines pages peut laisser à désirer, surtout si les pages originales ont été dactylographiées à l'aide d'un ruban usé ou si l'université nous a fait parvenir une photocopie de qualité inférieure.

La reproduction, même partielle, de cette microforme est soumise à la Loi canadienne sur le droit d'auteur, SRC 1970, c. C-30, et ses amendements subséquents.

Canada

UNIVERSITY OF ALBERTA

PROCEDURES OF POWER AND POSSIBILITIES FOR CHANGE IN SCIENCE EDUCATION CURRICULUM-DISCOURSE

by

DAVID W. BLADES ©

A THESIS
SUBMITTED TO THE FACULTY OF
GRADUATE STUDIES AND RESEARCH
IN PARTIAL FULFILMENT OF THE REQUIREMENTS
FOR THE DEGREE OF
DOCTOR OF PHILOSOPHY

Department of Secondary Education
University of Alberta

Edmonton, Alberta
Fall 1994

National Library of Canada
Acquisitions and Bibliographic Services Branch
395 Wellington Street
Ottawa, Ontario
K1A 0N4

Bibliothèque nationale du Canada
Direction des acquisitions et des services bibliographiques
395, rue Wellington
Ottawa (Ontario)
K1A 0N4

Your file Votre référence

Our file Notre référence

The author has granted an irrevocable non-exclusive licence allowing the National Library of Canada to reproduce, loan, distribute or sell copies of his/her thesis by any means and in any form or format, making this thesis available to interested persons.

L'auteur a accordé une licence irrévocable et non exclusive permettant à la Bibliothèque nationale du Canada de reproduire, prêter, distribuer ou vendre des copies de sa thèse de quelque manière et sous quelque forme que ce soit pour mettre des exemplaires de cette thèse à la disposition des personnes intéressées.

The author retains ownership of the copyright in his/her thesis. Neither the thesis nor substantial extracts from it may be printed or otherwise reproduced without his/her permission.

L'auteur conserve la propriété du droit d'auteur qui protège sa thèse. Ni la thèse ni des extraits substantiels de celle-ci ne doivent être imprimés ou autrement reproduits sans son autorisation.

ISBN 0-315-95152-4

Canada

UNIVERSITY OF ALBERTA

RELEASE FORM

Name of Author: **David W. Blades**

Title of Thesis: **Procedures of Power and Possibilities for Change in Science Education Curriculum-Discourse**

Degree: **Doctor of Philosophy**

Year This Degree Granted: **1994**

Permission is hereby granted to the University of Alberta Library to reproduce single copies of this dissertation and to lend or sell such copies for private, scholarly or scientific research purposes only.

The author reserves all other publication and other rights in association with the copyright in the thesis, and except as hereinbefore provided neither the thesis nor any substantial portion thereof may be printed or otherwise reproduced in any material form whatever without the author's prior written permission.

DwBlades.

David W. Blades
350 Sylvian Crescent
Saskatoon, Saskatchewan
S7H 5E7

Dated this 31 August, 1994

As soon as one can no longer think things
as one formerly thought them, transformation becomes
both very urgent, very difficult,
and quite possible.

Michel Foucault

UNIVERSITY OF ALBERTA

FACULTY OF GRADUATE STUDIES AND RESEARCH

The undersigned certify that they have read, and recommend to the Faculty of Graduate Studies and Research for acceptance, a thesis entitled PROCEDURES OF POWER AND POSSIBILITIES FOR CHANGE IN SCIENCE EDUCATION CURRICULUM-DISCOURSE submitted by DAVID W. BLADES in partial fulfillment of the requirements for the degree of DOCTOR OF PHILOSOPHY.

Wallie Samiroden
Dr. W. Samiroden (Supervisor)

H Kass
Dr. H. Kass (Committee member)

Dr. T. Carson (Committee member)

Sawada
Dr. D. Sawada (Committee member)

John Hoddinott
Dr. J. Hoddinott (Committee member)

TC. for Wm Doll
Dr. W. Doll (External examiner)

Dated this 22 August, 1994

DEDICATION

To my best friend and life-partner Edith
and my wonderful sons
Jesse, Daniel, Samuel, and Joshua.

ABSTRACT

Concerns about planetary environmental degradation and a general drift from positive attitudes towards science in the West, at a time when children are finding their school science experiences not relevant, has led educators to declare for the second time since World War II a crisis in school science education. The rise of STS science education may be a valid response to this crisis but curriculum change is hindered by the modernistic tradition of approaching curriculum change as a technical-rational problem. The continued barrenness of this technical-rational approach is revealed in this thesis through an interpretive study of the attempt from 1980-1990 in the Canadian province of Alberta to change secondary school science education towards STS science education. The failure of this reform suggests possibilities for change in science education curriculum-discourse urgently demands a post-modern response, a search for freedom from the defining enframement of modernity. To embark on this search, this thesis explores the implications of the concept of power in the works of the philosopher Michel Foucault to understanding the nature and activity of this enframement. A Foucauldian examination of the Alberta science education curriculum-discourse reveals procedures of power that prevented change in the curriculum-discourse by defining who may speak and what may be said, thus ensuring the continuation of a curriculum-discourse no longer relevant to the situation of our present age. To avoid contributing to technical-rational approaches to change, this thesis does not present a meta-theory for analyzing procedures of power in every curriculum-discourse or a formula of how to find possibilities for change. Instead, post-modern approaches to curriculum change are explored through a presentation that weaves personal, historical, and critical narratives and uses metaphors and an allegorical retelling of the procedures of power operating in the science education curriculum-discourse of Alberta. The post-modern presentation of this thesis invites readers to enter into a conversation of critique with the text in the hope that initiating such conversations of critique on the procedures of power in a curriculum-discourse opens the discourse to new, post-modern ways of thinking that may reveal possibilities for change in science education.

ACKNOWLEDGEMENTS

The journey of this dissertation was only possible with the kind support of friends and family and I acknowledge, with deepest heartfelt gratitude, the following who have contributed to this work:

Dr. Wallie Samiroden, Dr. Heidi Kass, and Dr. Terry Carson for serving as members of my supervisory committee from the Department of Secondary Education at the University of Alberta. Wallie supervised my research and was always there to help, guide, encourage and be a friend. Words do not exist that can express my gratitude for all he has done for me and my family. Heidi introduced me to the science education curriculum-discourse in Alberta destined to become the focus of my study and her guidance, inspiration and friendship to me and my family made my research possible. Terry first alerted me to the works of Heidegger which initiated readings that led me towards postmodernism. His friendship and conversation, in particular during our memorable trip from Dayton, Ohio to Louisville, Kentucky, was critical in helping me capture a vision of possibilities for curriculum change.

Dr. John Hoddinott and Dr. Daiyo Sawada, both from the University of Alberta, for serving as members of my examining committee for my candidacy and final defense and Dr. William Doll, Jr. of Louisiana State University for serving as my external reader. My dissertation is richer, more complex, and a deeper work because of the quality of their helpful comments.

My colleagues with Alberta Education, in particular Mr. Raja Panwar, Dr. Oliver Lantz, Ms. Bev Romanyshyn, Mr. Keith Wagner, Dr. Bob McClelland, Ms. Janice Leonard, and Mr. Jim Dinning for their kind, enthusiastic support of my research and Ms. Kathy Austin of Gage Publishing for her helpful insights.

My friends with the Department of Secondary Education at the University of Alberta for conversations that helped hone the fundamental ideas presented in my dissertation. In particular I extend my thanks to Dr. Ken Jacknicke, Dr. Wytze Brouwer, Dr. Larry Beauchamp, Keith Roscoe, Sandra Frid, Kalafunja O-Saki, Rillah Carson, Heather Ryan, Wancharee Mungsing, Dennis Summara, Laura Ho, Carl Leggo, the members of the "Question of the Other" reading group, Ms. Barb Keppy, Ms. Betty Kifiak, and my students in the EDSEC courses I taught.

My colleagues and students with the College of Education at the University of Saskatchewan for patiently supporting me while I completed

writing my dissertation. The encouragement I have received from faculty, suypport staff and students these past two years is deeply appreciated.

My mother, Ms. Kathy Blades and my father, Warrant Officer (Ret'd) William Blades, for their moral support and to my father-in-law, Rev. Carl Klassen and my mother-in-law, Mrs. Dora Klassen, for their prayers.

And especially to my wife Edith for her constant belief in the importance of my research, excellent editing, loving encouragement, and willing involvement in every phase of my work. Together with the love, humour and support of my sons, I can truly confess that while the words of the dissertation that follows are mine, completing this project was truly a team effort.

TABLE OF CONTENTS

INTRODUCTION 1

CHAPTER 1: MODERNITY AND IMPETUS FOR CHANGE IN SCIENCE EDUCATION 6
    Introduction: Narratives of Change 6
    Modernism and Destiny in Responses to the First Crisis in Science Education 8
        The First Wave of Science Education Reforms 11
        The Great Conversation 15
    The Second Crisis in Science Education: A Question From a Generation 20
        The Drift from Science 21
            The Voice of Students 22
            Changing Public Perceptions of Science 26
        The Growing Ecological Crisis 29
    Responses to the Second Crisis in Science Education 34
        The Challenge of Renewal in Science Education 34
        Hope and Possibilities in STS Science Education 36

CHAPTER 2: CHANGE AND THE GENESIS AND EVOLUTION OF SCIENCE 10-20-30 IN SCIENCE EDUCATION CURRICULUM-DISCOURSE 43
    Introduction: Science Education as Curriculum-Discourse 43
    Vision and The Genesis of Science 10-20-30 in Alberta 45
        The Proposed Changes to High School Science Education in Alberta 45
        The Genesis of Science 10-20-30 49
    The Development of Science 10-20-30 as a Modernistic Technical-Rational Act 52
    Controversy and Crisis in the Evolution of Science 10-20-30 58
        Destiny and the Discovery of Events in the Evolution of Science 10-20-30 58
        Controversy in the Science Education Curriculum-Discourse 61
    The Barrenness of a Structuralistic Explanation of the Evolution of Science 10-20-30 71
    The Griffin Arises: The Reconceptualization of Science 10-20-30 in the Alberta Science Education Curriculum-Discourse 74
        Reaction and Revision of the Science 10-20-30 74
    What is the Meaning of Educational Change? 80
        The Lesson of Science 10 80
        The Barren History of Curriculum Change 85
        The Determined Hope of Structuralism in Educational Discourse 86
    Rethinking Curriculum Change 87

CHAPTER 3: RE-SEARCHING POWER IN A SCIENCE EDUCATION CURRICULUM-DISCOURSE.......92
  Introduction: Beyond Modernity in Curriculum-Discourse.......92
  Foucault's Invitation to Re-Search Power.......94
    Foucault and Possibilities for Curriculum Change.......94
    What is the Purpose of Engaging in Educational Research?.......96
    Foucault's Rethinking of Power.......99
    The Influence of Foucault's Project.......102
      Foucault in Education Discourse.......103
  The Archaeology of Procedures of Power in a Curriculum-Discourse.......105
    Collecting Documents.......105
    Archaeology as a Trachealizing Act.......107
    The Dynamics of Interviewing.......110
      Rethinking Interviewing.......112
      Establishing validity.......115
      Ethical Considerations.......117
  An End and a Beginning.......122

CHAPTER 4: THE DESTINING OF POWER IN A SCIENCE EDUCATION CURRICULUM-DISCOURSE.......125
  Introduction: Wrestling an Angel.......125
  Allegory and Post-modern Dis-covering.......127
    Paradox and Possibilities in Post-modern Writing.......127
    Allegory and Metaphor in Post-modern Writing.......131
  The Quest.......134
  Procedures of Power in a Curriculum-Discourse.......137
    Destining Who Can Speak in a Curriculum-Discourse.......138
      The modification and legitimation of hierarchies.......138
        Bureaucratization.......140
        Silence.......141
      Active marginalization.......143
        Voices Without a Voice.......144
        Personal Invasion.......145
        The Voice of Critics.......147
      The Strategy of Consultation.......149
    Destining What Can be Said in a Curriculum-Discourse.......154
      Production of Knowledge.......154
      Production of Truth.......159
  Characteristics of Power in a Curriculum-Discourse.......162
    The Adaptability of Power.......164
    The Great Anonymous.......167
    Effecting an End to The Quest.......171
  Is Change in a Curriculum-Discourse Possible?.......175
    At the Edge of Modernity.......177

CHAPTER 5: HOPE AND POSSIBILITIES FOR CHANGE IN SCIENCE EDUCATION CURRICULUM-DISCOURSE 179
- At the Chasm of Despair 179
- Locations of Hope for Change in Science Education Curriculum-Discourses 181
  - The First Book: Foucault's Pedagogy 181
    - (The First Interruption: Encouraging Beginning Voices) .. 188
  - The Second Book: Heidegger's Warning 192
    - (The Second Interruption: Challenging Experienced Voices) 202
  - The Third Book: Nietzsche's Challenge 207
    - (The Third Interruption: Considering The Voice of Children) 212
- Towards a Post-Modern Science Education Curriculum-Discourse 216

POSTSCRIPT: CONTRAINDICATIONS IN WRITING A POST-MODERN DISCOURSE AND SOME THOUGHTS ON A POST-MODERN SCIENCE EDUCATION 223
- Writing a Post-Modern Discourse 223
- What Might Be the Characteristics of a Post-Modern Science Education? 228

BIBLIOGRAPHY 231

APPENDIX A: SUMMARY OF TOPICS IN BIOLOGY 10, CHEMISTRY 10, & PHYSICS 10 264

APPENDIX B: MICHEL FOUCAULT- A BRIEF BIOGRAPHY 266

APPENDIX C: LETTER OF PERMISSION FROM THE MINISTER OF EDUCATION OF ALBERTA 270

APPENDIX D: SPECIFIC INTERPRETATION QUESTIONS USED IN RESEARCHING PROCEDURES OF POWER IN A CURRICULUM DISCOURSE 271

APPENDIX E: GENERAL MAP OF THE KINGDOM 274

LIST OF TABLES

Table 1. Summary of proposed topics for Science 10, September 7, 1988 48
Table 2. Science 10 Draft Course of Studies, August 31, 1990. (Alberta Education, 1990d) 83

LIST OF FIGURES

Figure 1. Existing high school science programs of study in Alberta 46
Figure 2. Proposed changes to the high school science programs of study in Alberta. 47
Figure 3. Cartoon from the Medicine Hat News, November 25, 1989. .. 70
Figure 4. Development of a Research Project. 113
Figure 5. Dis- covery of the Procedures of Power in a Curriculum-Discourse. 123

INTRODUCTION

I was born only a few years before the former Soviet Union launched the first artificial Earth satellite Sputnik, yet this singular event played a major role in shaping the destiny of my generation. The tacit faith that science and technology could solve world problems was our inheritance and education; fear of the apparent technological superiority of a foreign power catalysed renewal in North American science education. The legacy of these reforms was an invitation to children world-wide, through the new and predominantly American and British science education teaching materials and methods, to become involved in a science related career. Many would accept this invitation, although haunted by a sense of hesitation about the modernistic claims of a better life through science and technology. Growing up in the fifties, sixties, and early seventies the promises of science and technology seemed contradictory: How could we reconcile the development of antibiotics, television, and transistors with DDT, nuclear weapons, and napalm? Yet we clung to the belief that problems facing our world might be solved through science and technology. Some of us became educators, investing our hope in the education of the next generation. But at the sunset of the twentieth century, optimism seems shallow and fears have returned. A deep suspicion about the claims of the Great Conversation of modernity has arisen from our experience and echos in the voices of our children. Faced with global concerns of rain forest depletion, water and air pollution, and dwindling natural resources for a growing population we are beginning to realize the promises of modernity are barren and our trust in a technological salvation betrayed.

From a dawning sense of crisis the last modern generation asks a truly post-modern question: Where is hope? Like the generation before us, our search has led Western countries once again to curriculum reform in science education; perhaps if our children understand the nature, activities, benefits and dangers of science and technology, and the relationship between science, technology and society (STS) the next generation may find a hopeful future.

I would like to present a dissertation that, through a case study of a recent attempt to change secondary school science education in Alberta, Canada towards an STS perspective, exposes the barriers to curriculum change and then presents solutions to the problems of changing secondary school science education curriculum towards an STS approach. In such a dissertation I could examine organizational hierarchies, lines of communication, and places where breakdowns in the development of this curriculum change attempt led to ineffectiveness. The formula of change could be our currency; we could deal in certainties, in new methods and techniques. I could make an explanation about the process of curriculum change that could be generalized and applied to other settings and situations considering curriculum change. My study could conclude with a presentation of a new theory of curriculum change; the task of changing any curriculum could be presented as a sequence of steps to be followed carefully, ensuring the change takes place as planned. Books elaborating these steps might be written and workshops given to administrators, teachers, and government officials on how to correctly manage the business of changing a curriculum. But the belief that curriculum change is essentially a technical problem to be solved is seductive and misleading. As we shall see, technical approaches to curriculum change demonstrate that such approaches slip easily, comfortably, and surely towards a siren, only to be shipwrecked, discouraged, and even left hopeless.

Our peril springs from the assumption we act freely when proposing solutions to problems of curriculum change. The act of speaking about curriculum change, which includes placing words on a page in a dissertation, involves constant choice. As Mathieu discovers in Sartre's The Age of Reason, freedom to choose is often "so remote" (1945/1969, p. 254). "We are," Hershel (1955) reminds us, "free at rare moments. Most of the time we are driven by a process; we submit to the power of inherited character qualities or the force of external circumstances" (p. 410). Hershel's observation suggests that the formation of a discourse that is one's own, brought forth by unique experiences and the convergence of events in space and time, also reflects the evolution of the many discourses we unconsciously participate in and belong to. These larger discourses may define how we speak, what can be said, and what is left unspoken, limiting our freedom to speak.

In the dissertation that follows, I argue that attempts to change secondary school science education curricula are founded on the positivistic, technical-rational assumptions of the discourse of modernity. Enframed by the Great Conversation of modernity, discourse on curriculum change seems destined to speak in technical-rational ways, to view curriculum change as a problem to be solved once all the factors preventing change are elucidated: a search for a correct method and generalizable technique of curriculum change. Through the example of the attempt from 1980 to 1990 to develop new secondary school science education programs in the Canadian province of Alberta, I reveal in the first two chapters of this dissertation how such technical-rational approaches and explanations of curriculum change are barren. The government of Alberta was one of the first internationally to attempt large-scale renewal of science education towards an STS approach. From my research of the attempt at curriculum change in this province I suggest that the formula for curriculum change will continue to be elusive. Even so, technicality seems to be entrenched in curriculum studies while a growing chorus of voices are calling for curriculum change in science education.

This call presents a dilemma: restricted by the tradition of modernity to approaching change as a technological problem that can be solved, the question "How is change in science education curriculum-discourse possible?" urgently demands a post-modern response. This response involves thinking and speaking about curriculum change in ways not thought or spoken before, a call to search for a way out of the comfortable, familiar defining frames of modernity to find hope and possibilities for curriculum change. As the twentieth century comes to a close, this call to find a post-modern response to questions about curriculum change from within our modern situation is charged with urgency and great difficulty.

Fortunately we are not alone in our struggle to find post-modern ways of speaking and thinking. The recent work of some philosophers directly challenge the prevailing technical-rational positivism of modernity. One of these philosophers, Michel Foucault (1926-1984), provides by example a way to understand how modernity works and where possibilities for change may lie. Foucault (1971/1989a) presents his project as an attempt to discover "those systems which are still ours today and within which we are trapped. It is a question, basically, of presenting a critique of our time" (p. 64). These systems are able to exist within the social body, Foucault claims, through a multiplicity of force relations which he calls *power*.

The dissertation that follows argues that Foucault's concept of power provides a way for us to understand the enframing activity of modernity and where hope and possibilities for curriculum change in secondary school science education may exist. My thesis is that a Foucauldian interpretation of the procedures of power in a particular science education curriculum-discourse, in this case the development of the Science 10, 20, & 30 secondary school science programs in Alberta, opens a conversation of critique that is capable of revealing possibilities for change in science education curriculum-discourse.

Of course, this thesis can not be presented as a formula of how to find these possibilities or a meta-theory for analyzing power in every curriculum-discourse. To avoid such modern destining I have tried to form the discourse of the dissertation that follows into a post-modern presentation. This presentation may be unfamiliar to many readers and before embarking on reading a few words are in order. First, I have endeavoured to avoid presenting a new theory of curriculum change or a stance that the procedures of power that I discovered in the curriculum-discourse in Alberta represent a set of generalizable factors to consider when initiating change. To do this I have presented my thesis through narratives that develop on three levels. The first level is the narrative of the recent attempt to change the secondary school science curriculum in Alberta, set in the context of the response of STS science education to the second crisis in science education in Western democracies since World War II. The second narrative is my own story of how the ebb and flow of science reforms came to affect my life and how I became directly involved in the science education curriculum change attempt in Alberta. With this narrative I share how I was both participant and observer of the attempt and how I came to interpret the events in Alberta in conversation with Foucault's work. This interpretation is part of the third narrative in the dissertation: the struggle for change in secondary school science education in the West since World War II. Each narrative level interrelates and intertwines, demonstrating that research is not a straight-forward process or series of steps to follow, but is part of a life journey that is not separate from the discourses that shape who may speak and what may be said.

The fact that this defining process does not have to be this way is the point of my dissertation. Through the archeology of power (Foucault, 1972/1969, 1989e/1969) in a particular curriculum-discourse via layers of narrative, I explore the nature and activity of our modern enframing, to use the word of the philosopher Heidegger (1954/1977), leading to a consideration of possible locations for change in a curriculum-discourse. One key location rests with the readers of this dissertation. I extend to my readers an invitation to enter into an on-going, hopeful conversation of critique with the text I present. Foucault defines critique as "seeing what kinds of self-evidences, liberties, acquired and non-reflective modes of thought, the practices we accept rest on" (Foucault, 1982, p. 33): a dis-covering of the way we think and act. This critique, claims Foucault, leads to change since "the moment one begins to be unable, any longer, to think things as one usually thinks them, transformation becomes simultaneously very urgent, very difficult, and altogether possible" (p. 34). This dissertation thus challenges readers through a conversation of critique to reflect on their own enframing, to discover how modernity defines who may speak and what may be said about curriculum change and, in so doing, to find possibilities for freedom from the destining of modernity. Before we begin this conversation of critique I make two requests. First, I ask readers to allow our conversation to remain open by avoiding forming opinions or conclusions too rapidly (Carson, 1986). A certain patience is needed as the narratives unfold and then recollect forward, as Kierkegaard (1843/1983) would describe it, through the allegory presented in the final two chapters of the dissertation. At many places in the dissertation the organization and presentation might seem odd, unfamiliar, and uncomfortable. In fact, this is my hope and intention: that through a post-modern presentation this dissertation will provoke conversation while discouraging modernistic appropriations of what I share. Second, I ask readers to remember that throughout the narratives that follow and in our conversation together in no way do I suggest that I have somehow found a pathway to post-modernity or that I am recommending a route anyone else may follow. No, I wish to avoid this telling slippage back to modernity and so I ask, as did Foucault (1969/1972) in the introduction to one of his works, that readers "do not ask me who I am, and do not ask me to remain the same" (p. 17). Let us leave such defining to others and choose instead to enter into a conversation of critique over the enframing of science education curriculum-discourse and through our conversation find hope and possibilities for change in science education.

CHAPTER 1
MODERNITY AND IMPETUS FOR CHANGE IN SCIENCE EDUCATION

Introduction: Narratives of Change

I am always impressed when teaching on the ability of stories to capture the attention of my students. The words, 'Let us begin with a story' are almost magical in the way the teaching relationship with students transforms from didactic to communal. Connelly & Clandinin (1990) observe this transformation is a key aspect of teaching, since "education is the construction and reconstruction of personal and social stories; teachers and learners are storytellers and characters in their own and other's stories" (p. 2). One purpose of forming stories, or narratives, suggests Greene (1987), is to engage in a journey of consciousness, an attempt to "go beyond, to reach towards imagined possibility" (p. 11). In other words, story telling is more than entertainment but an invitation to reflect together through the communion of story so that our shared wisdom might reveal possibilities otherwise covered by the business of living.

Finding these possibilities involves people telling stories "in words as they reflect upon life and explain themselves to others" (Connelly & Clandinin, 1990, p. 4). The public nature of this telling means that sharing stories, observes Pinar (1988), is a type of political action since "we are not the stories we tell as much as we are the modes of relation to others our stories imply" (p. 29). Popkewitz (1988) explains this further by reminding us that

> while we are immersed in our personal histories, our practices are not simply the products of our intent and will. We take part in the routines of daily life, we use language that is socially constructed to make camaraderie with others possible, and we develop affiliations with the roles and institutions that give form to our identities. We speak not only as ourselves but, as Foucault reminds us, as part of discourses of power as the social complexities and subtleties of intellectual life are inter-related with institutions. That which is seemingly normal and natural about our participation in the world are the very acts about which we need to become curious and critical. (p. 379-380)

The telling of stories can thus become a revealing of who we are, why we act and speak the way we do, a critical examination of how we live in the world and how else we might be. In this way, forming and sharing narratives becomes a call to action through a commitment to change present situations. This call to action does not only involve the individual sharing the story but includes those listening or reading the stories, adding these stories to their own and, hopefully, beginning a conversation where we become critical about our all too normal, comfortable, and natural participation in the world. The implications of these conversations of critique initiated through the sharing of narratives are explored further in Chapter 2.

Grumet (1987) advances that sharing narratives helps to "mark the territory that is to be the ground for meaningful action, thus establishing the perimeter of our freedom as well as our containment" (p. 320-321). The nature and activity of our modern containment, or enframent, and possibilities to move beyond this entrapment is a focus of this dissertation. To understand this enframing and where freedom for change lies, I begin in Chapter 1 the three narratives I outlined in the general introduction to the dissertation. Each narrative is a story of struggle for change. At the personal level, I share in Chapter 1 how, like Grumet (1987), I became "impatient with a kind of subordination I was experiencing, as if my whole life would be filled with stern and critical fathers, making sure I did not stray from a beaten path they had laid down" (p. 10). In successive chapters I share through the narrative of events in my life how this impatience led to an archeology of self that suggests possibilities for change. A second narrative that is wider in scope also begins, although briefly, in Chapter 1. This narrative tells and then later re-visits the story of the genesis and evolution of a set of new secondary school science education programs in the Canadian province of Alberta. The struggle to change science education in Alberta is examined in detail in Chapters 2 to 4, discovering possibilities for change despite the characteristic resiliency to change of educational systems. Finally, I begin in Chapter 1 to deconstruct and lay bare some aspects of the great narrative of Western modernity, what I call in Chapter 1 the Great Conversation of modernity. This largest of all narratives is intimately linked to the other two, forming a nexus of relations explored in the pages that follow. The relentless and effective ability of the Great Conversation in setting the boundaries of our journeys needs to be examined critically if change in science education is to have any hope of success. Two events in space exploration are symbolic of our modern situation in the Great Conversation. We now turn to the first of these events and the beginning of the weaving of the three narratives that explore where hope and possibilities for change in science education might exist.

Modernism and Destiny in Responses to the First Crisis in Science Education

> The sober desire for progress is sustained by faith--faith in the intrinsic goodness of human nature and in the omnipotence of science.
> Hoffer (1951), The True Believer, p. 8.

On July 20, 1969 Neil Armstrong, the 38-year-old commander of Apollo 11, slowly descended a ladder and extended his foot to touch the powdery surface of the moon. As Armstrong placed the first human footprint on an extra-terrestrial body, he captured the hopes of the world in the historic phrase: "That's one small step for man, one giant leap for mankind"[1] (O'Toole, 1969, p. 2). Wilford (1971), then staff reporter covering the Apollo project for the New York Times, recalls how humankind seemed on the brink of interplanetary travel: "the moon, long the symbol of the impossible, was now within reach, the first port of call in the new age of spacefaring" (p. 20). This was not idle speculation. Von Braun (1970), director of the George C. Marshall Space Flight Centre, felt the Apollo 11 mission reinforced the "utter conviction that tomorrow's knowledge and technology will provide the means to attain the goals" of interplanetary flight, "sooner than thought" (p. *x*). The very day of the lunar landing Mueller, Associate Administrator of the National Aeronautics and Space Administration (NASA), declared "the triumph of Apollo is nevertheless only a beginning" towards establishing a lunar base "within the next decade" (Mueller, 1969, p. 14). Not even a year after Armstrong's historic first step onto the lunar surface, science writer Ruzic (1970) predicted over 50 voyages to the moon would be made by Americans and Russians by 1975, leading to a permanent lunar base. Ruzic confidently suggested that by 1990 there would be space flights to Mars and well established lunar science research and astronomy stations that would employ a permanent and growing population on the moon.

I just completed grade nine when I joined a world community of 500 million (Harvey, 1969) temporarily linked through the medium of television to watch the historic lunar landing. "No one," commented editor Snaddon of the major newspaper of the city of Edmonton, Alberta, Canada, the Edmonton Journal, "could watch the televised pictures of earthmen walking on the moon without a tightening in the throat, a tear or two of emotion, and a surge of vicarious pride in being a member of the human race" (p. 2). As we watched the almost unreal unfolding of events culminating with Armstrong and Aldrin walking on the moon, we felt the power in former United States President Johnson's optimism that America could now "do anything that needs to be done" ("Johnson Says," 1969, p. 15). For many around the world, the mission to the moon "dramatized the possibilities" (Reston, 1969, p. 11) that technological solutions exist to world problems. In Israel, Prime minister Meir spoke of the "great future ahead of us" and Pope Paul VI called for the application of the effort and thinking behind the Apollo mission to be now applied to "true progress toward the temporal and moral good of humanity" (Farrell, 1969, p. 10). Foreign Minister Schulmann of France suggested the historic event "opens for all humanity prospects of a considerable extent," agreeing with President Spychalski of Poland's confidence that "the flight will serve peace and all mankind [sic]" (Southam News Service, 1969, p. 29). For many people, the Apollo landing represented hope for prosperity since "the spillover from the space technologies would create new products and new opportunities" (Smith, 1990, p. 76). In the summer of 1969, I knew I wanted to be part of these new challenges, part of the journey of humankind to the stars. I also knew, after considerable personal agonizing, what would be my career: I would help humanity; I could find solutions to the world's problems: I would become a scientist.

---

[1] "One small step for man" was a common misquote of Armstrong due, at least initially, to the poor transmission of the communication signal from the moon. Armstrong actually said, "one small step for *a* man."

I had been practicing. When I was only seven my father gave me a microscope. It was a kit with prepared slides, some preserved specimens, a needle probe, and a wonderful optical instrument that opened views of worlds beyond my dreams. I vividly remember the first specimen I examined with my new microscope: a prepared slide of the hairs of a silverberry plant, stained all shades of the rainbow. I was spellbound, absolutely speechless at the view. A few years later, my father brought me a telescope. Late into the night I would gaze at the phases of Venus, the blueness of Rigel and the redness of Mars. I made detailed maps of the moon, longing to travel there someday. When I entered junior high school my father brought me a chemistry set. Though we had to evacuate the house when I produced too much sulphur dioxide gas during an experiment, he never complained; well, not *too* much. His love of learning, fascination with all things scientific, and faith in scientific research as the foundation to material progress became my inheritance. I was not alone. My best friend Rob and I planned joint biology ventures that would make us rich, Larry had chemistry equipment that was the envy of us all, Karl built electronic equipment in his basement, and Fraser launched insects into the sky with a rocket set. By junior high school, all of us wanted to be scientists. Our generation, at least the boys I knew, continued to build our lives on what Johnson (1991) calls the "foundation stone" of modernity: the fundamental conviction that "science and technology seems to make all things possible for humanity" (p. 360). In the summer of 1969, the Apollo 11 achievement seemed evidence prima facie of the unlimited potential of humanity through science and technology.

Ten years before the Apollo mission, the United States Academy of Sciences held a ten day meeting held at the U.S. Oceanographic Research Institute in Wood's Hole, Massachusetts to "discuss how education in science might be improved" in the primary and secondary schools of the United States (Bruner, 1960, p. vii). Stimulated by funding support from the National Science Foundation (NSF) of the United States (Viall, 1962), initiatives to renew topics and structure of American science education were well under way before the Wood's Hole Conference.[1] Wood's Hole, then, was a retrospective appraisal of the process and direction of the new American science education programs and an exploration of how continued renewal in science education might proceed; this was a curriculum conference.

Attendance at the Wood's Hole conference reflected a movement in post-World War II American education towards a focus on "the structure of content" (Giroux, Penna & Pinar, 1981, p. 5) of high school subjects: Of the thirty-four men attending Wood's Hole, only two represented the field of education. The unchallenged suppositions of the meeting at Wood's Hole reflected the modernistic primacy of progress through the applications of scientific thinking: Leading researchers in behavioural cognitive science, such as Gagné, Cronbach, and Bruner met with university natural scientists, psychologists, mathematicians, historians, and representatives from other disciplines to consider the following questions about school science education:

> What shall be taught, when, and how?
> What kinds of research and inquiry might further the growing effort in the design of curricula?

---

[1] For example, the Physical Science Study Committee (PSCS) had completed a new high school physics programme, other courses of study such as a high school biology programme through the Biological Sciences Curriculum Study (BSCS) and high school chemistry programmes developed through the Chemical Bond Approach (CBA) and the Chemical Education Materials Study (CHEM) were in the at various stages of design and trials in schools before the Wood's Hole Conference (Viall, 1962, p. 5).

> What are the implications of emphasizing the structure of a subject, be it mathematics or history, emphasizing it in such a way that seeks to give the student as quickly as possible a sense of the fundamental ideas of a discipline? (Bruner, p. 3.)

Bruner's summary of discussions at the Wood's Hole Conference, The Process of Education, (1960) quickly became a "most influential little volume" (Giroux, Penna & Pinar, p. 5) that had a powerful effect in shaping the research and direction of the field of curriculum (Giroux, Penna & Pinar, 1981; Shubert, 1993). Clearly, the meeting at Wood's Hole supported the direction and approach of the American science education reform initiatives. The Wood's Hole conference enthusiastically endorsed the movement to allocate decisions about the content, approach and structure of school science education to "those with a high degree of vision and competence in each of these fields," which Bruner (1960) identifies as "the best minds in any particular discipline" (p. 19); that is, outstanding university and corporate researchers. Bruner argues for continued development of school curricula that emphasizes "the fundamental structure of whatever subjects we choose to teach" (p. 11). These new school programs, suggests Bruner, would help all students achieve the "full utilization of their intellectual powers" (p. 11) so that the United States "will have a better chance of surviving as a democracy in an age of enormous technological and social complexity" (p. 11). Bruner suggests, however, an undemocratic focus in education with his plea a few sentences later that new curriculum directly appeal to the "top quarter of public school students from which we must draw intellectual leadership in the next generation" (p. 11).

The First Wave of Science Education Reforms

The move towards school science programs designed by scientists grew from a widespread post-War sentiment in the United States and Canada of a need to revise school science programs. Marshall (1962) observed that American science education during the forties was "at too great a variance with modern concepts of science and too far removed from the educational needs of contemporary society to meet the needs of the period ahead" (p. 2). Hurd (1964) argues scientific progress stimulated by World War II had transformed America from an "agrarian society to a scientific-technological society" (p. 7), leading to a "demand for men and women trained for scientific and technological vocations"

(p. 7). Post-War United States and Canada was in such need of a trained scientific community, that in an earlier essay Hurd (1961) describes science education in the early fifties as one of "confusion and crisis" (p. 108). In the midst of the "accelerated growth in science and technology following the close of World War II" (Hurd, 1961, p. 108) educators in the United States and Canada found their school science curriculum emphasized science as "a static body of knowledge" (Marshall, 1962, p. 3) that was "largely oriented to a culture that no longer existed, and taught from a content that had lost its scientific significance" (Hurd, 1964, p. 7).

Wartime innovations, such as RADAR, proved the importance of science development to national security. This lesson was not lost in North America; spectacular successes in atomic energy and electronics led to the popular public myth that "if you take a great doctor and surround him with scientists in a laboratory, and if you have a clear-cut objective and pour essentially unlimited amounts of money into that system, you can do anything" (Schon, quoted in Senate Special Committee on Science Policy, 1970, p. 72). The Canadian government acted on this belief through large investments involving high technology; specifically atomic energy and the ill-fated military aircraft programs of that era. Similar projects were the focus of government spending in the United States with the important addition of education. Post-War concerns in the United States about the spread of communism and fear of scientific and technological progress in the former Soviet Union encouraged U.S. government agencies, including the military, to invest in educational research (Helgeson, Blosser & Howe, 1977). Almost immediately upon inception by government statue in 1946, the U.S. Atomic Energy Commission (AEC) and the U.S. Office of Naval Research began funding projects cryptically termed "mission-oriented basic research" (Smith, 1990, p. 49) that included curriculum renewal efforts in university science education. Public criticisms of American schooling, such as American Admiral Hyman Rickover's claim that American education was "soft," (Giroux, Penna & Pinar, 1981, p. 4) prompted academics, supported with government funds, to form in the early fifties the school science education curriculum committees destined to be enthusiastically endorsed at the Wood's Hole Conference.

Saturday morning, October 5, 1957 patrons of the Toronto Globe and Mail awoke to the headline: "RUSSIA LAUNCHES FIRST SATELLITE" ("Russian launches," 1957, p. 1). Washington was quick to congratulate the Soviet Union on the "remarkable achievement" (p. 2) of producing the first human-made satellite Sputnik; although the chief of American naval operations quipped the Russian satellite was "a hunk of iron almost anybody could launch" (p. 2). Disconcerting to readers in North America was the announcement by the Russian news agency Tass that the Soviet Union planned to send up within a year *several* more artificial satellites that would pass directly over North America ("More Likely," 1957, p. 9). The following day the Globe and Mail reported the agreement of British experts that the new technology could be used as "spy in the sky" ("Second Soviet," 1957, p. 57). An essay by Schwartz (1957) of the New York Times carried in the October 9, 1957 edition of the Globe and Mail (p. 6) introduced another area of concern: The rocketry technology to place a satellite in orbit means Russia also must have intercontinental missile capabilities.

The Globe and Mail editorial of Wednesday, October 9, 1957 bluntly acknowledged the launching of Sputnik "shocked the complacency of nations where science is an accepted part of life, and whose attainments therein have been taken for granted as setting the pace for the rest of the world" (Dalgleish, 1957a, p. 6). The solution to this situation, according to the editor, was to make much larger sums of money available to the National Research Council of Canada, amounts to be worked out by "those who know the field" (p. 6). While the position of the Editor seems supported by statements made by Canadian Prime Minister Diefenbaker (Davey, 1957), U.S. President Eisenhower claimed to be "undisturbed" by the launching of Sputnik (Deane, 1957, p. 1-2), although some journalists in the United States were suggesting the President could not "bring himself to admit that it was under his administration that the United States fell behind" (p. 2).

The launch of Sputnik II by the former Soviet Union on November 4, 1957 brought an end to the President's public blasé attitude towards Soviet achievements in space technology. Carrying a dog as passenger, Sputnik II gave credence to Russian boasts that a trip to the moon by Soviet cosmonauts "may be near" ("Half-Ton Sputnik II," 1957, p. 1). Claims by the Soviet Union the following day that Sputnik II was launched "by a new source of power" ("Reds Say," 1957, p. 1) led to an emergency meeting of the United States Cabinet. A poignant editorial comment in the November 6, 1957 issue of the Globe and Mail captured the mood of both Canada and the United States at this time:

> The two Sputniks buzzing about the earth may be taken as a judgement upon us. A judgement, and perhaps a final warning. If we of the West are going to survive in the world, if we are even to hold our present level of power and wealth, *we have got to care very deeply about education and the people associated with it.* We have got to care as much as the Russians, and indeed we may have to care more. For they seem, in a good many ways, to be ahead of us. (Dalgleish, 1957b, p. 6. Emphasis mine.)

From crisis came commitment. Four days after Sputnik II began orbiting the Earth, U.S. President Eisenhower announced a massive "overhaul" of the American science-defense infrastructure that included plans to stimulate school science education in the United States (Drury, 1957, p. 1). In the wake of the Soviet launches, the United States government passed the National Defense Education Act (NDEA) (1958) that "provided funds for university education and fellowships" (Smith, 1990, p. 50) with the result that "millions of dollars were devoted to the cooperative involvement of scientists, educators, and learning theorists in the development of science curriculum materials" (Helgeson, Blosser & Howe, 1977, p. 1). Prior to 1960, 93 percent of all post-War U.S. government funding of educational initiatives came from the Department of Defense, AEC and NASA (Smith, p. 50), illustrating how issues of national security influenced the direction and approach of American science education reform in the fifties (Helgeson, Blosser & Howe). The goal of this investment of funds and personnel in science education was the production of "top-notch, career scientists" (Champagne & Hornig, 1986, p. 2; also Matthews, 1989) through study of the traditional structures of the disciplines of biology, chemistry, and physics (Nadeau & Désautels, 1984). Though science education in the fifties and sixties was oriented towards the recruitment and selection of an elite corps of students that were invariably a "homogeneous group of white males" (Champagne & Hornig, p. 2), the support and endorsement of these initiatives in science education by leading academics at the Wood's Hole Conference guaranteed few would question this approach to science education curriculum development.

The launching of the two Sputnik satellites led to an unparalleled degree of activity in efforts to reform school science education, beginning with the United States and Britain (Eisner, 1979; Fensham, 1988b; Helgeson, Blosser & Howe, 1977). Through extensive financial support of the NSF in the United States and the department of national defense with the passing of the NDEA, millions of dollars were invested in the production of various new science programs for American elementary and secondary schools, leading some science educators to describe the sixties as the era of the "alphabet soup" American science programs (Kyle, Shymansky & Alport, 1982).[1] In Britain the 'Cold War' climate "heightened concerns about national shortages of scientists and technologists" (Layton, 1984, p. 225) contributing, together with concerns that science education was not keeping pace with scientific discoveries and the general social changes in British education, to the development in the early 1960s of the Nuffield Foundation schemes (Waring, 1979, p. 62-63). These schemes, similar to the American science courses, were "designed largely by academic scientists" (Matthews, 1989, p. 3) with the focus of "being able to create little scientists" (p. 3).

During this time of intense curriculum development Canadian provinces tended to play "a spectator role" (MacKeracher, 1985, p. 96), choosing to import to school systems with little or no modification the American science education programs developed in the early sixties such as BSCS, CHEM Study, and PSCS (MacKeracher, 1985; Tomkins, 1977). The acceptance of these new science programs in Canada, notes Tomkins, reinforced "the widespread assumption that Canadian schools were carbon copies of their counterparts to the south" (p. 10). Canadians were not alone as spectators in during the first round of curriculum reforms in science education. British curricula were adopted in the latter sixties in countries such as Malaysia (Tan, 1991) and Nigeria (Jegede, 1988) while the American programs were imported verbatim or translated widely in a wide diversity of countries such as Australia (De Laeter, 1989; Fensham, 1988b), Turkey (Ayas, Cepni, & Akdeniz, 1993), Israel (Tamir, 1988), and Japan (Troost, 1985).

The Great Conversation

The British and American science programs that were exported to Canadian provinces and countries world-wide display in orientation, spirit, and approach what Hutchins (1952) calls "The Great Conversation" (p. 1). According to Hutchins, the dominant element of this great conversation "is the Logos" (p. 1), where

---

[1] For example, in addition to existing high school science programmes, the early sixties saw the publication of Science -A Process Approach, the Elementary Science Study, Science Curriculum Improvement Study, Minnemest, COPES, and many others.

> nothing is to remain undiscussed. Everybody is to speak his [sic] mind. No proposition is to be left unexamined. The exchange of ideas is to be the path to the realization of the potentialities of the race. (p. 1)

Belief in the positive value of inquiry and enunciation to human progress echos in the most ancient philosophies. Modern expressions of this spirit of positivism emerged during the European Enlightenment (ca. 1350-1650) through the "precepts of Bacon, the conceptions of Descartes and the discoveries of Galileo" (Aiken, 1956, p. 129) and discoveries and innovations in science and art during that era (Durant, 1961; Schaeffer, 1968).[1] The modern legacy of the European Enlightenment is a "logocentric metaphysics of presence" (Madison, 1990, p. x) that has come to dominate Western thinking for the past three hundred years. Foundational to this metaphysics of modernity is the belief that a rational subject can truly come to know objective reality and this knowledge can be used positively to further human progress "to the effecting of all things possible" (Bacon, 1625/1942, p. 288). How is this knowledge achieved? The successes of the scientific revolution amidst the European Enlightenment directed the focus of the Great Conversation towards science: knowledge of the objective world is possible through reasonable, logical, experimental inquiry. Human progress, assured the eighteenth century philosopher Compte, will come once people extend "to social phenomenon the spirit which governs the treatment of all other natural phenomenon" (Compte, quoted in Zeitlin (1987), p. 65). In his Cours de Philosophie Positive,[2] Compte argues for a "positive philosophy" based on scientific inquiry:

> Under the rule of the positive spirit, again, all the difficult and delicate questions which now keep up a perpetual irritation in the bosom of society, and which can never be settled while mere political solutions are proposed, *will be scientifically estimated*, to the great furtherance of social peace. (quoted in Zeitlin, 1987, p. 65. Emphasis mine.)

Compte's assertions of the primacy of scientific knowledge above other ways of knowing (Aiken, p. 116-117) became a modern, public belief during the nineteenth century as "men and women could see wealth increasing on all sides, while science and technology seemed to make all things possible for humanity" (Johnson, 1991, p. 360). A tacit faith in the primacy of science and technology to human progress became a common theme in popular fiction as writers anticipated the twentieth century; for example, Verne's Twenty Thousand Leagues Under the Sea (1870), Ibsen's An Enemy of the People (1882), Doyle's The Sherlock Holmes Mysteries (1891), and Shaw's Major Barbara (1905) were in harmony with the spirit of Hugo's (1887/1862) recommendation for social progress in Les Miserables : "science is authority rightly understood. Man [sic] should be governed only by science" (Volume I, p. 45). During the first fifty years of the twentieth century astounding scientific discoveries, such as the structure of the atom, homones, antibiotics and the existence of Rh factors in human blood and spectacular inventions through scientific research, such as RADAR, digital computers, electron microscopes, transcontinental telephone service, airplanes, television and electrocardiograms (Sanders, 1981; Grun, 1979) seemed to confirm the optimistic faith of nineteenth century modernity that through science and technology our species might be able to accomplish almost anything, solve any problem. In the early fifties few North Americans would have doubted the accuracy of Bertrand Russell's assessment in 1952 that one hundred fifty years of modernity have proved scientific inquiry to be an important "source of economic technique capable of transforming human life" (Russell, 1952, p. 9).

---

[1] Advances in science, philosophy, and art over many centuries are part of the rich history of India, communities in Africa and Asia, and Moslem and Jewish settlements. To speak of The Enlightenment" would be to betray a very Euro-centric perspective, thus I refer to this era in Western Europe (and by extension, to colonies in the New World) as the "European Enlightenment."

[2] Path of Positive Philosophy

This modern, logical positivism permeates the science education reforms of the late fifties and early sixties. Tacit faith in science and technology to solve problems and guarantee progress led the attention of funding agencies to naturally fall towards the American scientific community to play the major role in the design and approach of new school science programs. Bruner's Process of Education provided "theoretical support for the curriculum reform movement" (DeBoer, 1991, p. 158) in science education. This "seminal work" (Eisner, 1979, p. 53) was a modernistic approach to curriculum reform that was destined to guide "most nationwide curriculum development projects of the 1960s" (McNeil, 1977, p. 48). Three key assumptions were foundational to the activity of the science education reform of that era:

1. Assumptions of expertise

Bruner's proposal to base the design of school science programs "on the structure of the academic disciplines" (McNeil, p. 48) reflected the assumption by funding agencies such as the NSF that the design of science education curricula is "itself a scientific activity" (Stenhouse, 1985, p. 2) best left to scientists. To encourage children to experience biology as a biologist, chemistry as a chemist, or physics as a physicist (Nadeau & Désautels, 1984) experts in the science disciplines became school curriculum writers and advisers during the fifties and sixties (Giroux, Penna & Pinar, 1981). The publication in 1960 of Bruner's The Process of Education emphasized the expertise of non-education specialists in curriculum reform. Whether this assumption still underpins recent attempts at science education curriculum reform in the Canadian province of Alberta will be examined in Chapter 2.

2. Assumptions of curriculum

I began my secondary school education while living in the Canadian province of British Columbia and it was at this time that I first encountered the new American science programs The new science courses, we were told, were so new and revolutionary all our school could provide at this moment was mimeographed handouts of the BSCS text and laboratory manuals, although we were promised new textbooks and films were on their way. It was enough. Intrigued with the physiology, anatomy, and ecology of organisms I devoured the unusual applications of Greek and Latin sounds familiar to the practicing biologist. My success in learning to speak the language of biology led me, and many of my classmates, to consider careers in the biological sciences.[1] Our teacher, unfamiliar with the new materials, simply acted as a guide to our journeys. In that classroom the authority for our studies came from the authors of the BSCS materials; to us the new biology curriculum was the textbook and laboratory manuals we were using.

This perception of the American science reform curricula as materials-in-use with authority located somewhere distant to the classroom was accurate. In a U.S. National Science Teacher Association (NSTA) position paper on post-World

---

[1] I still possess the career brochure entitled *Why Biology?* published by the Biological Council of Canada (Skorkna, 1971. Sherbrooke, Québec: Page-Sangster). A group of us sent away for this book during our senior years in high school, revealing our high interest in the field of biology and the initial success of the BSCS programme in attracting young people at our school to consider science careers.

War II science education curriculum reforms Hurd (1964) describes the new science curricula as courses of study that are constructed, organized, and then implemented in schools. Helgeson, Blosser & Howe (1977) report the focus of this curriculum activity was the development and publication of science education textual materials. These materials, claims Eisner (1979), were developed with the assumption that "nationally known scholars would be able to provide teachers with a higher quality of materials that teachers could create on their own" (p. 38). The consequence of locating science education expertise outside the classroom was the development of 'teacher-proof' science education textual materials and subsequent definition of curriculum as text.

3. Assumptions of method

Through his work on the nature of science education and direct involvement in the development of the BSCS program, Schwab was seen during the science education reforms as a "spokesman for the importance of discipline-based teaching of science in schools" (Westbury and Wilkof, 1978, p. 24). In his influential essay, Education and the Structure of the Disciplines (1961), Schwab argues for a school science education curriculum that is, "from the start, a representative of the discipline" (Schwab, 1961/1978, p. 269). Schwab continues in his essay to recommend a science curriculum based on Compte's structuralistic approach to knowledge and philosophical stance of positivism, leading naturally to the consideration of curriculum development in science education as a scientific problem. This view was not unique; as we have seen, the Wood's Hole conference endorsed a structuralistic, scientific approach to curriculum building in science education. Neither was this approach new; as we shall see in Chapter 2, modernistic approaches to curriculum reform began a decade prior to the development of "alphabet soup" science programs of the sixties.

The three-fold strategy in the early sixties of replacing science programs rather than revising previous curricula, looking to professional scientists rather than educators for leadership of the reforms, and infusion of massive federal funding support for the new initiatives initially seemed successful. Student enrolment and achievement in high school science programs increased in schools that adopted the new science programs (Kyle, Shymansky & Alport, 1982). Although large scale assessments of school science education was not conducted in Canada or the U.S. during the early sixties, smaller studies indicated students in schools using the new science curriculum-materials were engaged in science programs that minimized lecturing in favour of discovery learning (Helgeson, Blosser & Howe, 1977). The glowing optimism surrounding the Apollo mission moon landing at the end of the sixties provided modern assurance; faith in the unlimited possibilities of science would continue. Exposed to the new science curricula in our senior years, one goal of the reforms seemed within reach: many of my classmates announced at our high school graduation ceremonies their intention to pursue science-related careers.

I travelled in a slightly different direction. Inspired by my high school science teachers, I decided my future lay in teaching high school biology. Embarking on a career as a high school science teacher, I eagerly anticipated my university courses in microbiology, zoology, chemistry and physics. Near the completion of my education degree with a major in biological education, I was taught how to plan lessons that reflected Schwab's focus on the discipline of a science field. I worked hard to find the best way to deliver to my students the content, structure, and approach of various science disciplines, especially biology. I wanted them to love and experience science as I had. After four years of university study in sciences and one year of education courses, I felt ready to teach! I knew my science, I could plan lessons, I was ready for the classroom. I was not prepared, however, for the single, sincere question Albert S. was to ask during my first few years teaching high school science.

The Second Crisis in Science Education: A Question From a Generation

> Crisis, even if it does not comprise the totality of human life, nevertheless belongs necessarily to human life; and has a necessary function to fulfill in it.
> Bollnow (1987), Crisis and New Beginning, p. 5.

It was, as I remember, a hot Friday afternoon. I was teaching a rather obscure concept in a senior chemistry class, when Albert S. raised his hand. "Sir," he asked sincerely, "why are we learning this crap?" Phrased poorly, I had to admit it was a good question. I turned to the blackboard and stood facing the notes and diagrams I had so carefully crafted for the past fifteen minutes. Why were my students learning this, I wondered. I could not honestly see any connection to their lives, any use, any real reason a student in high school should learn the esoteric concept I had been teaching for the past half hour. "I suppose," I responded slowly, "so you can continue in your science studies at university." I could tell neither of us felt comfortable with my answer! The lesson concluded and students were dismissed, but Albert's question stayed after class. I recognized at this point, for the first time in my life, Albert had given a voice to a dis-ease that had been steadily growing within my thinking. Vaguely aware something was amiss in science education, I embarked on further studies during my summer breaks to learn more about the curriculum I inherited and so faithfully represented.

The Drift from Science

I began my graduate studies of curriculum in the summer of 1984. There was considerable excitement that year over the publication of the results of a four year study by the Science Council of Canada (SCC) of school science education in Canada and the findings of Canadian involvement in the Second International Science Study (SISS) of the International Association for the Evaluation of Educational Achievement (IEA) (1984). One essential purpose of these studies was the assessment of attempts at post-Sputnik science education curriculum reform in Canadian science education. In 1979 the now defunct Science Council of Canada (SCC) decided to embark on a study of Canadian science education "in response to various criticism that had begun to surface during the previous few years" (Orpwood & Souque, 1984). From 1980 to 1984 the SCC reviewed provincial science curricula through case studies, textbook reviews, interviews, document analysis, examination of Ministry of Education guidelines for science education and engaged in consultation with interest groups throughout the country.

The SCC review reached a rather blunt recommendation: "Renewal in science education is essential. Now" (SCC, 1984a, p. 2). Many concerns surfaced as a result of the SCC study, including a lack of Canadian content in science education, missed opportunities for all students to study science, the entrenchment of science programs that present an inaccurate view of the activity of science and the failure of science courses to relate science to technological or societal issues. The two year IEA/SISS study (1982-83), a comprehensive descriptive study of science education in Canada, observed a growing trend in Canada to include environmental education in the science curriculum and demands for more Canadian content in science education (Connelly, Crocker, &

Kass, 1985). Researchers also found teachers in Canada want more control over the development of the science programs they teach (p. 318).

There were similar studies in the late seventies and early eighties in the U.S.; so many, in fact, that that era has been described by some educators as the "decade of reports" in the U.S. (Victor & Kellough, 1993, p. 10).[1] Three major studies of science education in the U.S. by the NSF during the years 1969-1977 provided "substantial evidence that serious attention needs to be paid to improving the quality" of pre-college science education (Smith, 1980, p. 55). A review of American post-Sputnik science education assessments by the Panel on School Science (1980) of the NSF concluded that "the whole educational system is in trouble" but science education in particular has displayed "considerable slippage" in instructional quality and student academic performance during the seventies (p. 84).

I was shocked by these studies of science education and in particular by the SCC studies. In my movement from high school student to classroom science teacher I simply assumed the high school science I experienced as a student would remain valuable to my students. Indeed, my instructional approach was based at that time on the models of my past science teachers and university professors. But the evidence from the science education assessments spoke clearly, challenging my conceptions of what it means to teach children science and the views of science held by the generation of students I was teaching. This was only the beginning of the conceptual challenges waiting for me. The further I explored the vast regions of science curriculum, the more voices I heard calling for reform in science education.

The Voice of Students

Statistics Canada (1992) reports during the seventies "full-time post-secondary enrolment increased" in Canada (Chapter 5, p. 1) as the so-called 'baby boomer generation' graduated from secondary schools. A survey of Statistics Canada's publications from 1969 to 1985 of the Canada Year Book reveals a steady increase in students graduating with science-related degrees until the mid-seventies.[1] Numbers plateau during the latter seventies until the early eighties when most university science areas began to experience a steady decline in their numbers of graduates.[2] DeBoer (1991) reports a similar phenomenon in the United States during the latter seventies. British students are also choosing to not continue studies in science after secondary school, leading Stenhouse (1985) to suggest an international pattern among Western democracies:

---

[1] For example, during the years 1983-1984 over 120 national studies of educational progress were published in the U.S. (Victor and Kellough, p. 11).

> All the educational might and ingenuity of the most powerful Western democracies has been lavished, since about 1960, on the development and improvement of education in the various sciences--and what has been the outcome? Recruitment to science has suffered not only a relative but also in many cases an absolute drop. The young adults who were expected to provide the scientific work force and the spearheads of original research for the 1980s and beyond have been voting with their feet; they have gone into the humanities, and the social sciences, and 'business studies', and so on, rather than the basic sciences. (p. 3)

The drift from a career in science was reflected in the lives of my close high school friends. Although many had announced at graduation in the early seventies that they were pursuing careers in science, most of us drifted to other areas. Rob dropped out of university to manage a lumber store. Larry became a manager trainee at a Bank, Fraser worked for the telephone company and I, although still somewhat involved in science, had become a teacher. Of my closest high school friends, only Karl had chosen the only career related to science with his rather timely employment in the field of computer software design.

Part of the Drift from Science by my classmates and other students in the seventies and eighties may be due to the inability of the science reforms of the sixties to make a significant impact on school science instruction (DeBoer, 1991). Already by 1973, Stevenson complained that the real legacy of the sixties reforms in Canada was the realization that "we did not learn how to make the fundamental changes that led to genuine reform" (p. 52). Hurd (1991b) agrees with this assessment, complaining that "despite the turmoil over the science curriculum during the past decades, not much has happened" (p. 35). In the United States, only 22-25 percent of the educational boards ever adopted the new science programs designed in the sixties (DeBoer, 1991; Kyle, Shymansky &

---

[1] The word "science" is interpreted widely to refer to health sciences, physical and biological sciences, and applied sciences.

[2] Notable exceptions are the fields of forestry and engineering; these areas enjoyed steady increased enrolment until the late eighties.

Alport, 1982; Panel on School Science, 1980) while Canadian provincial Ministries of Education found that when they tried to introduce the new programs "most science teachers were ill-equipped to teach them" (MacKeracher, 1985, p. 99). What did appear in Canadian schools during the seventies were science courses that emphasized "the structure of the discipline, addressed the relatively advanced theoretical concepts, and were explicitly designed to increase the supply of trained scientists and engineers" (SCC, 1984b, p. 14).[1] Often missing from these courses was the enthusiasm and deep understanding of the values, nature, and processes of science characteristic of the early versions of new science programs. It seems *the vision of the new programs never reached the classroom*; instead the new programs became absorbed into a tradition of science education at the secondary level being important "only to those who intended to study those subjects at university" (SCCb, p. 14). Aikenhead (1980) claims this focus on specialization and recruitment in science education allowed high school science to continue in schools as dry, content-laden courses of study that are "socially and culturally sterile" (p. 15). Science programs that focused on content invariably became classrooms lessons consisting "mainly of rote memorization of words that are useful for passing tests" (Beardsley, 1992, p. 103) that bored or intimidated children causing, suggests Beardsley, many young persons to become "turned off" science at "an early age" (p. 103).

By the latter 1970s, the failure of educational reform in science education became apparent in Canada through studies that revealed students attitudes towards science sharply decline when these students enter secondary school. Connelly (1987) reports that Ontario students' attitude towards science drop sharply in grade nine. Similar results were found in an assessment of science education in British Columbia in 1986. In Canada, the IEA/SISS found Canadian student attitudes towards science do drop in grade nine, but those students still enroled in science in their senior year do tend to have similar attitudes towards science as students in grade five (Connelly, Crocker & Kass, 1989). Blades (1992a) discovered grade twelve students in Alberta believe science is an important subject of study, but in general these students are "not finding their experience in senior science courses very relevant, rating their overall experience only 5.2 out of a possible 10" (p. 15). Aikenhead (1986) discovered a similar pattern among students in the Canadian province of Saskatchewan; his studies suggest that while students value science, most also describe their high school science studies as boring and not relevant to their lives.

---

[1] A notable exception was the ALCHEM programme (1972-1977). Developed in Alberta, this programme featured a Canadian content and was one of the first secondary school programmes in North America that linked studies in science to social concerns (Connelly, Crocker, & Kass, 1985).

Secondary school students in the U.S. reflect declines in attitudes towards science similar to their Canadian counterparts. In a comprehensive review of the results of the Third National Assessment of Science Education in the United States (1978), Yager and Yager (1985) note that in general "students have better perceptions concerning science, science classes, science teachers, the value of science, and what it is like to be a scientist in grade three than when they are in grade eleven" (p. 356). In a follow up study, Yager & Penick (1986) found "the more years our students enrol in science courses, the less they like it" (p. 360). The IEA/SISS study reveals a similar trend world-wide, with generally very positive attitudes towards science among ten year olds, but by the time these students are in the senior years of secondary school attitudes have become neutral or only weakly positive, with many students around the world indicating they have decided not to pursue a career in science.

Ironically, the lack of relevancy of the science reforms of the late fifties and sixties to students in the 1970s and 1980s and declining attitudes towards science as children move towards completing their public schooling may be due to the focus of those programs on attracting young persons to science careers. Kass & Blades (1992) explain that for many students today science careers

> tend not to be viewed as particularly prestigious. For the training involved, being a scientist is perceived as a somewhat low-paying career with few, if any, perks. Scientists may have somewhat poor working conditions, e.g. smelly laboratories, tramping through the bush alone, and often somewhat little real power or influence, since research funding dictates that they work for the interest of business, e.g., consultants for pulp mills. "What is so great about being a scientist anyway?" Is a question increasingly asked by young persons today. (p. 2)

Compounding this lack of interest in a science related career is the perception held by young persons that high school science courses are difficult (Beardsley, 1992; Blades, 1992a; Kass & Blades, 1992) and the misperception among students in Western democracies that anyone willing to study and tackle high school science courses such as physics must be a "nerd, brain, geek" or some other derogatory label (Jones & Hutchings, 1993, p. 1; Beardsley, p. 103).

Postulating a relationship between the drop in student attitudes towards science and declining numbers of students graduating from universities with degrees in science related fields may be simplistic. Students are part of general society, their voices reflect and are mixed in the chorus of the general public. Even before Apollo 11 left on its historic voyage in 1969, a general drift in public belief from the modern assumption of the centrality of science and technology to human progress had begun.

Changing Public Perceptions of Science

In the heady optimism of the summer of 1969, some critics "persisted in saying the Apollo program cost too much, that the money and talent could be more usefully directed to fighting disease and poverty" (Wilford, 1971, p. 21). Concerns about scientific endeavours were not new. Popular works such as Stevenson's Dr. Jekyl and Mr. Hyde (1886), Well's The Time Machine (1895), Huxley's Brave New World (1932) and Orwell's dark 1984 (1949) express deep reservations about modern faith in science and technology. Shelly's classic tale Frankenstein (1831/1988) is one of the earliest criticisms of scientific research in the modern era. Bent on creating a living being just to see if it could be done, the words of the young Dr. Frankenstein are hauntingly contemporary:

> Had I the right, for my own benefit, to inflict this curse upon everlasting generations? Now, for the first time, the wickedness of my promise burst upon me; I shuddered to think that the future ages might curse me as their pest, whose selfishness had not hesitated to buy its own peace at the price, perhaps, of the existence of the whole human race. (p. 189)

Doubts about the unbridled growth of science first entered post-World War II public discourse with the 1962 publication of Silent Spring by Carson and Nader's 1965 book Unsafe at any Speed (Smith, 1990, p. 74).[1] Perhaps for the first time the general North American public became aware that technological benefits of science also generate risks (Champagne & Hornig, 1986). In his analysis of American science policy since World War II Smith suggests the inability of Americans to win the war in Vietnam (1965-1973) was part of the public drift from science as the Western world realized the "most powerful and technologically advanced nation on earth was unable to subdue a technologically backward enemy" (p. 76). Commenting in particular about the situation in the United States, Smith (1990) observes that the 1960s and 1970s

---

[1] This book documents some of the devastating effects of indiscriminate pesticide use on wildlife. Carson's book caused a furore with the general public in Canada and the U.S. which was influential in banning the use of DDT in the U.S. and Canada and the subsequent creation of the Environmental Protection Agency in the U.S.A. Nader's book was not in particular anti-science, but rather a "criticism of corporate interests for misusing technology for short-sighted economic gain" (Smith, p. 74).

> were a time of conflict, divisions, shifting attitudes and loyalties, and wrenching social change. The policy conflicts and underlying differences in values shook all institutions and all settled habits of thought. Society's support for science had been placed on the assumption that progress in the various scientific disciplines would ultimately lay the foundation for a better life for all Americans. Social improvements of all kinds would follow when the nation's collective intelligence was brought to bear on the most pressing problems. But as Americans lost confidence in this premise, as their optimism about the future became tinged with pessimism, the foundations of society's support for science-and scientists themselves-eroded. (p. 77)

Problems world wide with poverty, racism, civil unrest and widespread abuse of drugs during the sixties did not diminish as the Western democracies entered the seventies; the hope of Apollo was followed by growth in public "sullenness" (Borgmann, 1992) and rising anti-science sentiment (Holton, 1992; Passmore, 1975; Smith, 1990; Stenhouse, 1985). Already by 1971 Yale Professor of Chemistry Wolfgang (quoted in Layton, 1973) notes a change internationally in public attitude towards science in his address to the International Conference on Education in Chemistry:

> Science has never been fully accepted by humanity. It has been tolerated because of the material benefits it can provide. But now it is being increasingly questioned whether these practical benefits of science are indeed benefits. (p. 1)

The "crisis of legitimacy in science" (Bruffee, 1992, p. 22) in the Great Conversation in the West marks the beginnings of the end of modernity as public disenchantment with the primacy of science and technology to progress took root (Passmore, 1975).

The erosion of faith in science and technology to human progress within Western democracies is partially due to the very public displays of scientific activity in the latter half of the twentieth century. Through the medium of television we have been able to witness the spectacular side of science and technology, such as the landing of men on the moon, and the tragic. On January 28, 1986 I brought television to my classroom so my grade ten students could watch the launching of the U.S. space shuttle Challenger. Shuttle flights had become so routine by this time that "we had been encouraged in the belief that boarding a shuttle is like catching a bus" (Webster, 1986, p. A6). This particular shuttle was unique, however, in that for the first time a civilian passenger, a school teacher, would be riding along. This teacher was to relay science lessons about space from the orbiting shuttle to an estimated "2.5 million" children ("Children," 1986, p. A14) as part of a NASA education initiative called project Classroom Earth. I had been in contact with NASA's chief education officer and had coordinated the start of my science unit on space to coincide with the Shuttle launch and the broadcasts by the space bound science teacher Christa McAuliffe. What began as another U.S. space triumph became the "worst disaster in space exploration" (Johnson, 1986, p. A1) as the shuttle exploded in full view of live television coverage seconds after lift off, killing all seven astronauts aboard. The horror and deep sadness felt by my students and I was expressed well by then Canadian Prime Minister Mulroney's commentary that the Challenger disaster was a "painful blow for all of us around the world whose hopes and dreams were on board that valiant team" ("Mulroney sends message," 1986, p. A.14). Wilford, the same New York Times columnist who covered the Apollo mission, summarized the mood of many with the remark that "the almost casual acceptance of technology exploded Tuesday in a fireball" that has shaken us "into an appraisal of the bargain modern society makes in relying too much on advanced technology" (Wilford, 1986, p. A7). Wilford's prediction that "seeing the Challenger, with its crew of seven on board, blow up in the sky in the full view of everyone at Cape Canaveral and all the others watching on television will leave an indelible impression in the world's memory" (p. A7) was correct, at least for me. As I write these words I can still see the white fireball as the shuttle exploded, feel the horror anew, and recall how my faith in technology and science was challenged by the sudden, terrible destruction of a system I thought foolproof.

During my graduate studies the summer following the Challenger disaster my belief in the benefits of technological achievements and the enterprise of science was challenged further when a professor remarked far too casually to us that objectivity is a myth. Completely unnerved by this claim, I countered with my long-held belief that the scientific method is a truly objective, altruistic process. The professor used my claim to open a discussion what he termed 'the dark side of science.' My peers were able to quickly list modern examples of this dark side: scientific experiments in concentration camps by Nazi doctors, the decision to use tactical nuclear weapons on the population of Hiroshima, environmental consequences of DDT use, invention and use of napalm in Vietnam, the Volta river project in Ghana, the Love Canal disaster at Niagara Falls, birth defects due to the use of thalidomide, and the breakdown of the American nuclear reactor at Three Mile Island were a few of the examples listed. Visvanathan (1987) reminds us that only in "the laboratory state of modernity" could these developments take place.

My studies that summer were difficult. Personal forays into the history and philosophy of science forced me to agree with Suzuki (1992) that while some scientists may work in the pursuit of truth and benefit of humankind, most "exhibit the entire range of human foibles from idealism to greed, zeal, and bigotry" (p. D12; see also Savan, 1988). I had always believed in, and taught to my students, the primacy of the pure, rational scientist solving the world's problems. But the foundations of my modern world view began to crumble as I began to realize that "scientific investigation is not a straightforward act of observation and recording, but rather a complex series of personal choices and subjective interpretations" (Savan, 1988, p. 21). Graduate studies continued to demonstrate to me that "in the final decades of the twentieth century we find ourselves nearing the end of a long tradition in which science has been viewed as completely rational, objective, and philosophically neutral quest for knowledge about the natural world" (Brouwer, 1985, p. 13). The importance of graduate study to change is explored in Chapter 5 of this dissertation, in my life reflection and reading about the dark side of science and the myth of objectivity in scientific research pushed science to the edge of the pedestal it once occupied in my thinking. My growing concern over planetary ecological degradation finished this movement, pushing science off.

The Growing Ecological Crisis

One of my favourite weekend pastimes growing up on the west coast of Canada was building driftwood rafts on a nearby beach with my friends. We would pretend to be pirates, floating our galleons into the bay where we would swim and dive for shells. During breaks from classes in my summer graduate program I would revisit these same spots, only to find the beaches so polluted that swimming is forbidden by law. The clean sand and driftwood I remember a few decades ago is now accompanied with such filth and debris that walking beside the ocean in certain places is hazardous and disgusting. My testimony is not unique. Suzuki (1989a) reminds us that

> within the lifetime of our elder citizens, the planet has changed almost beyond recognition. Their childhood recollections are not simply the musings of old folks for the good old days, but they constitute a living record of the cataclysmic degradation that has taken place around us in the span of a single human life. (p. 127)

This witness to destruction is part of a dawning public realization that "the environment is under siege and that the quality of life will be compromised if nothing is done" (McInnes, 1989, p. 1). "Everyone," suggests Wilson (1991) "is now more aware of the staggering array of global concerns facing us all. If global warming doesn't get us then the ozone hole will. If we don't poison our environment with toxic wastes then we will suffocate in a rising tide of unmanageable garbage" (p. A16). Reflecting a growing public concern about global ecology, feature issues devoted to ecological concerns seem to dominate the popular press as the 1980s came to a close.[1] The Southam Environmental Project Insert (1989) presented in the October 7, 1989 edition of The Edmonton Journal summarizes the tone of the popular press in the observation that "the destruction we have wrought since the Industrial Revolution is not so much to the Earth, but to the conditions on Earth that support human life. There is very little time left" (p. 1). In his popular best selling novel Jurassic Park, Crichton (1990) uses the character of Dr. Ian Malcolm, to echo this perspective: "Let's be clear. The planet is not in jeopardy. We are in jeopardy. We haven't the power to destroy the planet--or to save it. But we might have the power to save ourselves" (p. 369).

There may be very little time left to act. Suzuki (1989b) reminded readers in a newspaper column a few months after the publication of the Southam Environmental Project Insert that eminent scientists such as Erlich of Stanford University and Lovejoy of the Smithsonian estimate that we have little more that a decade to turn the present eco-crisis around. This gloomy picture is supported in McLaren's (1990) preface to the Royal Society of Canada book on global change, Planet Under Stress :

---

[1] See the issues of National Geographic (December, 1988); Time (January, 1989), Discover (April, 1990); Rolling Stone (May 3, 1990); Canadian Consumer (No. 7&8, 1990); Maclean's (September 17, 1990).

> The human animal that has moved out of ecological balance with its environment. Humankind is a wasteful killer and a despoiler of other life on the planet. This normal and apparently acceptable behaviour has been licensed by a belief that our use of the Earth's resources is God-given, and encouraged by an economic system that emphasizes short-term profit as a benefit. We are only slowly learning to put a real cost on the resources we consume, and the wastes we produce. Humankind is now dominant in effecting perhaps irreversible change on the Earth's surface, and I suggest that we do not know enough to decide how to run this planet. (p. *xiv*)

Few would argue with the United Nations World Commission on Environment and Development (1987) assessment that "over the course of this century, the relationship between the human world and the planet that sustains it has undergone a profound change" (p. 22). Scientist Lovelock is considerably more blunt. In his proposal the Earth can be viewed as a single organism he calls Gaia, Lovelock (1991) presents a chilling metaphor: "As a vast collective, the human species is now so numerous as to constitute a serious planetary malady. Gaia is suffering from *Disseminated Primatemaia*, a plague of people" (pp. 155-156).

There is little agreement about what can be done to preserve the conditions needed for the survival of our species on Earth, what Lovelock euphemistically terms healing Gaia. The United Nations promotes through the International Union for Conservation of Nature and Natural Resources and the World Wildlife Fund the concept of "environmentally sound sustainable development" (United Nations Environment Program, 1990, p. 3) or planetary management through science and technology. The Association of Professional Engineers, Geologists and Geophysicists of Alberta (APEGGA) defines this sustainable development as a "green" science and technology that encourages industrial growth while ensuring a healthy environment (APEGGA, 1991, p. 4). The belief that economic, social, and ecological problems can be addressed through "governmental use of science and technology" (Fusfled, 1979, p. 5) in such a so-called green approach is an expression of modernistic faith in a technological salvation to the problems facing our species (Blades, 1990). This "technoptimism" (Blades, 1990) is reflected in the Canadian government publication, Science and Technology in Canada. According to this publication, if we are to "provide new jobs...solve environmental health, and safety problems... create new products and educate our children for the future" then Canadians must "be players in the international field of science and technology" since "the quality of our lives in the future depends on science and technology" (Government of Canada, 1988, p. 2). International business consultant Feather would agree with the tone and encouragement of the Canadian government. In his book G-Forces Feather (1989) suggests that "it is time for some straight talk and fresh ideas about the exciting prospects for the future of the world (p. ix). In complete contrast to what he calls the doomsday predictions of scientists such as Suzuki, Lovejoy, and Erlich, Feather outlines thirty five global forces of change and technological innovation, or G-forces, which he insists offer the opportunity for humankind to achieve its "collective destiny" (p. 1) through a "combination of global, futuristic and opportunistic thinking skills that are *applied* in understanding and reinventing the world" (p. 9, emphasis his). University of Maryland Professor of Business Simon suggests the fact we've been able to clothe, feed, and house the majority of the world's population indicates "we're on a permanent roll with no limit in sight" (Simon, quoted in Berreby, 1990, p. 48). In an interview in the popular science journal Discover, Simon proposes that dire prophesies of looming ecological disaster represent a lack of faith in the abilities of our species to solve monumental problems.

It is precisely this technoptimism that worries futurist Rifkin. Rifkin (1983) suggests that humans have relentlessly fashioned from the crust of the Earth a "new home for themselves" (p. 6). This industry has led, claims Rifkin, to a "shortage of raw energy and resources necessary to maintain that home" (p. 6). The result is humankind facing "two crises simultaneously. The earth is running low on its stock of burnable energy and on the stock of living resources at the same time" (p. 6). Rifkin (1987) is not encouraged by recent developments in biotechnology, which he argues springs from the same utilitarian attitudes that have led to our present environmental situation. To Rifkin, the brave new world promised by the technoptimists is not really new nor a world he wants for his children.

The voices of technoptimists contrast with those who sense environmental concerns are inevitable symptoms of the consequences of modernism. For many, hope lies in finding a new way to live in the world, not in modernistic faith that some technological solution exists. Instead of working towards the total humanization, or management, of our planet, suggests Oelschlaeger (1991), we need to reconceive our existence as "interwoven, harmoniously coexisting in mutually supporting system" of the wilderness that is Earth (p. 18). Oelschlaeger's idea of wilderness is close to Lovelock's view of the Earth as a living organism, or Gaia. It is modernistic arrogance, argues Lovelock, to suppose we would be ever capable of managing the vast complexities of Gaia. The concept of sustainable development is, according to Lovelock (1991),

> the greatest of errors. Consider how the well intentioned application of the principles of human welfare and freedom that moved us all in the second half of the 20th century has failed our bright expectations. Cruel tyrannies now reign in much of what has been labelled the Third World. In spite of modern medicine, in many places the quality and length of life diminished as the land dies. (p. 175)

Our hope for the future lies, claims Lovelock, in "establishing a basis of a new civilization in harmony with Gaia" (p. 180), although he is short on advice on how this new relationship might begin or what shape it may take. Suzuki (1989a) agrees with Lovelock's diagnosis and recommendations, reminding readers that "the only way to get off our destructive path is to develop a radically different perspective on our place in nature" (p. 183). Unlike Lovelock, however, Suzuki advances the position that hope lies with the education of our children since they

> have most at stake since they will inherit the world we leave them; since they have not invested time and effort in the status quo, they are still receptive to possibilities and options. So we must fight to save as much wilderness as possible while simultaneously working to ensure our children are different from us. (p. 183)

The dilemma, according to Suzuki, is that while the "most important issues that the next generation will have to contend with will result from science and technology" for many children today "the way science is taught in school turns them off, and too many have stopped taking any science courses midway through high school" (p. 190). As discussed earlier, this crisis in science education is well documented. Public suspicion over the claims of modernity, attention on the activity and results of science and technology, and questions about which direction to take in dealing with environmental degradation has led voices within the Great Conversation to speak once again of renewal in science education. The impetus for change in science education this time, however, is far more than the threat of the technological superiority of a foreign power. If estimates are correct, our children and perhaps our grandchildren may be the last generations capable of finding a way to live with changing planetary systems. The crisis facing humankind is how to find possibilities for global survival in the midst of declining faith in the premises of modernism precisely at a time of exponential growth in the knowledge, complexity, and activity of science and technology. I submit that in this crisis it is not an exaggeration that renewal in science education is essential to the survival of humankind.

Responses to the Second Crisis in Science Education

The standard-bearers of the new reform movement insist this time
things will be different.
Beardsley (1992), p. 100, commenting on the "second wave" of science education
curriculum reforms that began in the mid-1980s.

The Challenge of Renewal in Science Education

In a speech to the first International Cell Biology Congress (1979) U.S. Senator Edward Kennedy (1979) suggested that from precedents in scientific achievement:

> One lesson is clear. The public must participate in the resolution of issues in which science impacts on society. They must be in on the takeoff as well as the landing. They must help formulate the key public policy questions which must be answered, and they must participate in the commissions and other groups convened to resolve these issues. (p. 17)

Growing concerns over ecological degradation and rapid increases in science and technology has made Kennedy's case for public involvement in science more compelling than ever. The Committee on High-School Biology Education (1990) of the U.S. National Research Council reminds us that

> population growth has placed new strains on the environment-massive pollution of air and water, deforestation and extinction of species, global warming and shifts in climate, and alternations in the ozone shield. We are engaging in the greatest uncontrolled experiment in human history, and the outcome if far from clear...What is certain, however, is that these issues are here to stay; *and a necessary step to their resolution in a democratic society will be increasing the scientific sophistication of elected officials and the public.* (p. 5, emphasis mine.)

The ability of students to form "informed policy judgements with respect to science and society" (Zeidler, 1984, p. 411) through an understanding of the characteristics and limitations of science has been termed "scientific literacy" (Aikenhead, 1983; Bybee, 1985; Cox, 1980; Roberts, 1983; Yager, 1984; Zeidler, 1984). By the mid-seventies assessments of science education in the U. S. and Canada revealed post-Sputnik science education reforms had not encouraged the scientific literacy of students. The Science Council of Canada studies indicated Canadian fare no better than other industrialized nations in developing the scientific literacy of our citizens (Orpwood & Souque, 1984). The U.S. National Commission on Excellence in Education publication, A Nation At Risk (1983) and the U.S. National Survey of Science and Mathematics Education (1985-86) results "implicate America's education system for contributing to the public's science illiteracy" (Goodwin, 1988, p. 52). Indeed, O'Neil (1992) estimates only seven percent of the American public "can be considered scientifically literate" (p. 2). Keeves (1992) comments that his review of the data collected by the IEA international studies of science education (1970-71, 1983-84) indicates a need to "raise the general level of science literacy" world wide (p. 20). The deplorable lack of science literacy among citizens and the inability of science education to make a significant difference in this illiteracy, combined with the almost overwhelming problems the next generation of adults must face, is yet another facet in the declaration for the second time since World War II of a crisis among Western nations in science education (Duschl, 1990; Hurd, 1989; Klopfer & Champagne, 1990; SCC, 1984b; Yager, 1984).

What is not clear at present is what direction reform in science education might take (Hurd, 1994; Kass & Blades, 1992). Educators could hardly be blamed for feeling nostalgic about the single, driving purpose of the post-Sputnik reforms and the vast amounts of financial support available. Those days are clearly over: grim economic realities world wide and present issues in science education reform have made reforming science education even more complex and difficult than in the late fifties and sixties. Consider *only a few* of the questions raised by educators about the direction of reform in school science education (Blades, 1986; Duschl, 1990; Keeves, 1992; Matthews, 1992; SCC, 1984b):

- How might a renewed science education increase students' attitudes towards science and scientific literacy?
- Should science continue to exist as a separate school subject, or should integration with other school subjects become a focus of renewal?

- How can young women be encouraged to consider careers in science related fields? Should science education continue to focus on career training?
- What is the role of the scientific community in determining the direction of science education renewal?
- Should environmental education be emphasized in school science or become a new course of study?
- Is the history and philosophy of science an appropriate foundation for a renewed school science education?
- Should science education focus on the process of discovery in science, the generation of scientific theories, or on the mastery of content or some dynamic mix of all three?

A major goal of the Canadian SCC study was to address some of these pressing questions. The SCC Report 36 (1984) lists eight recommendations for renewing Canadian science education arising from its four year study:

Science Education for All
1. Guaranteeing science education in every elementary school
2. Increasing the participation of young women in science education
3. Challenging high achievers and science enthusiasts
Redirecting Science Education
4. Presenting a more authentic view of science
5. Emphasizing the science-technology-society connection
6. Setting science education in a Canadian context
7. Introducing technology education
Monitoring Science Education
8. Ensuring quality in science education

As we shall see, the fifth recommendation was in step with an international movement to reform science education and this recommendation, together with the others, provided further impetus for the curriculum change effort in the Canadian province of Alberta, which is the focus of one of the narratives in the next chapter.

Hope and Possibilities in STS Science Education

In the midst of uncertainty and increasing voices in discussions about the direction of the second major science education renewal since World War II, a theme has emerged. At the 1975 annual meeting of the NSTA Stanford Professor of Education Hurd, a key player in the formation and activity of the Biological Science Curriculum Study (BSCS), announced in his key note address that the science curriculum projects of the sixties have proved to be "too restricted, fragmented, and hierarchical to focus on the science-based social problems with which students must deal as citizens" (Hurd, 1975, p. 30). Hurd then proposed a major shift in the focus of science education towards interdisciplinary studies based on understanding the relationships between science, technology and society, a view of science education that came to be known as STS science education.[1]

The purpose and focus of this STS approach is to "reach the larger audience of students with non-science careers and goals" by adopting a flexible pedagogy which considers the "humanistic and societal issues of science along with the facts of science" (Duschl, 1988, p. 51). The consideration of these issues, many directly created by technological advances, allows students in STS science education the chance to debate and consider the role of science and technology in the society they will form and presently influence (Jenkins, 1990). With an emphasis on science for all students and not just the elite few headed for science careers, STS science education represents a radical break from the approach of post-Sputnik science education. Instead of a focus on the structure of a particular science discipline, STS science education "is sound pedagogy" since students are "exposed to aspects of science through their own familiarity with its social applications" (Zeidler, 1984, p. 412). DeBoer (1991) notes how this change in focus represents a radically new type of science education in "the call to *organize* science courses around contemporary social issues instead of the concepts of science themselves" (p. 186, emphasis his). What should result from this new, radical STS approach to science education is a course of study that is more relevant to students since in their studies students address the issues they face now and must deal with in the future as members of a democratic society (Aikenhead, 1985; Hurd, 1985; Ramsey, 1993). Many science educators agree that an integrated study of the relationships between science, technology and society is essential to helping the present generation of children develop the skills, attitudes, and thinking abilities needed to deal with the crises facing our species as we enter the twenty-first century (Aikenhead, 1983, 1994; Blades, 1986; Bybee, 1987; Fensham, 1988b, 1993; Hurd, 1989; Jenkins, 1990; Ramsey, 1993; Rosenthal, 1989; Yager, 1981, 1984, 1992; Zeidler, 1984).

---

[1] In some regions, for example the Canadian Province of Saskatchewan, Canada, the letter 'E' is added to indicate the relationship between science, technology, society *and* the environment.

By the mid-1970s and early 1980s several science courses that adopted a partial or total STS perspective appeared world-wide. The Netherlands was one of the first countries in the world to produce an STS science course through the Physics Curriculum Development Project (PLON), which produced a STS physics course that existed in the Netherlands from 1972-1986 (Eijkelhof & Lijnse, 1988). ALCHEM, a locally developed secondary school curriculum in chemistry developed from an STS perspective was available in Alberta, Canada from 1972-1977. In 1983 two STS projects, Science in Society and Science in a Social Context were introduced in Britain by science education associations (Hunt, 1988). The Association for Science Education (ASE), the main professional science teacher association in the United Kingdom, set up a Science and Technology in Society (SATIS) project in 1984. This program was destined to become very widely distributed, partially due to the the introduction of the British national curriculum in 1987. A key resolution of this curriculum was the requirement that all children in Britain "to take science and technology up to the age of 16" (Central Office of Information, 1988, p. 3). As early as 1977, students in the Australian state of Victoria could enrol in the STS science course, Physical Science, Society and Technology (Fensham, 1988). Fensham (1993) reports on a *science for all* movement in the state of Victoria, which led to an effort in 1988 to reform all secondary school science course in Victora towards an STS approach. A similar movement is reflected in the new national curriculum introduced in New Zealand (Ministry of Education, New Zealand, 1992). The U. S. has been somewhat behind other countries in developing STS courses, but American agencies such as the National Science Foundation (NSF), the American Association for the Advancement of Science (AAAS) and the National Science Teacher Association (NSTA) support or currently sponsor curriculum reform projects that develop an STS perspective in science education (AAAS, 1989; Bybee, 1991; Hurd, 1991a; O'Neil, 1992; NSF, 1990; NSTA,1985).

An STS approach to science education seems to have wide support internationally. Gaskell (1980) notes that already by the late 1970s "scientific and technological literacy and science and society are 'in' concepts in science education communities around the world" (p. 26). Bybee and Mau (1986) report on an an international survey that supports Gaskell's claim. They found widespread support among science educators internationally for an STS approach to science education. Fensham (1988) reports that two thirds of the delegates at 1985 conference of the International Organization for Science and Technology

Education (IOSTE) report movements to reform science education in their countries towards an STS perspective, some twenty-two countries in all. Yager (1992) observes that currently the reform of science education towards an STS perspective "is a focus in nations on every continent" (p. iii). Articles appearing in the International Council of Associations for Science Education (ICASE) 1992 Yearbook reports on struggles to reform science education towards an STS perspective in countries such as Korea, Israel, Australia, the United Kingdom, the Netherlands, the United States, and among countries of the continent of Africa (International Council of Associations for Science Education, 1992). There seems to be enough interest world-wide in an STS approach to science education that some educators suggest STS represents an emerging new paradigm in science education (McFadden, 1990a; Pedersen, 1992), although Fensham (1988b) suggests that "the main stream of high-status science education in most countries is, however, still only marginally touched by the STS movement" (p. 376).

Not so in Canada. Clearly ahead of most countries, as already mentioned, some secondary school science courses oriented to an STS approach already appeared in Canadian provinces during the 1970s. By the close of the next decade most provinces were at various stages of initiating science education reform towards an STS approach. According to Krugly-Smolska (1992), initiatives to reform science education towards an STS approach in other provinces were "heavily influenced by the Science Council Study and its background discussion papers" (p. 3), in particular Aikenhead's (1980) Science in Social Issues: Implications for Teaching. Recommendation 5 of the Science Council of Canada's study of Canadian science education calls for "science to be taught at all levels of school with an emphasis and focus on the relationships of science, technology and society in order to increase the science literacy of all citizens" (SCC, 1984a, p. 7). British Columbia had the first province-wide response in Canada to this challenge with the introduction of a new science course for secondary school students, Science and Technology 11 (1986). This STS program was intended for non-academic students and a successive course was never fully developed. Alberta was the first province to adopt an STS approach to renewal of *all* secondary school science courses, non-academic and academic. As we shall see in Chapter 2, this initiative, which also included the development of an entirely new set of general, integrated STS science courses called Science 10, 20 & 30 began in that province during the early 1980s and was given a legal mandate by the Government of Alberta in 1985. What happened to these new courses is one of the narratives in the next chapter.

Other provinces were soon to follow in the footsteps of Alberta, keeping Canada in step with other Western countries. In 1986-87 the Saskatchewan Department of Education embarked on a major study of science education in that province. One result of this study was the recommendation that "science curricula at all levels of K-12 education should include a science-technology-society-environment emphasis" (Hart, 1987, p. 23). After four years of research Aikenhead published in 1991 a grade 10 STS science textbook, Logical Reasoning in Science & Technology (LoRST) (Aikenhead, 1991). Phillips (1986) claims science education in Manitoba integrates "technology and society components" (p. 22) but reports that a committee reviewing science education in Manitoba recommends more emphasis could be placed on STS education. Currently, the K-9 science curriculum in Manitoba is "in the process of revision" to meet this recommendation (Education Manitoba, 1990, p. 29). Nova Scotia is currently attempting to revise their senior science courses towards incorporating "science/technology/society interaction themes into the science curriculum" (Education Nova Scotia, 1990, p. 7). McFadden (1990b, 1991) describes the changes in Nova Scotia as an attempt at "fundamental transformation" (p. 4) of science education towards an STS approach. The Ontario Ministry of Education (1988) policy statement Science is Happening Here recommends a focus on the interactions of science and technology is essential in helping young children become "concerned participants in society" (p. 5). British Columbia has recently embarked on massive changes to their entire educational system, including the revisions of high school science towards an STS perspective (Government of British Columbia, 1989).

It was during these attempts at major curriculum reform in science education for the second time since World War II that I completed my graduate studies in 1986. My new understanding of science as a human activity and interest in possibilities in curriculum change in science led me to revive considerably my approach to teaching high school science! My students were challenged to ask deep questions about the activity of science, the role of scientists in society, and the relationships between science, technology, and society. I became more of a mentor to these children, guiding their discovery of science. Lecture notes were replaced with activities, topics began with an exploration of Albert's question, still reverberating in my life: Why are we learning this? I began to wonder, though, about the possibilities of change. Individual teachers might experience a renaissance in their thinking, but the education system in general seems to be largely impervious to large scale change. Yet I felt the changes I had experienced in my own classroom were significant indicators of the possibility of change in science education. After a long and difficult struggle, I felt it was time for me to leave my career as a high school teacher for further studies in education. In the summer of 1988 my family and I moved to Edmonton so that I could begin studies at the University of Alberta. As I drove the moving truck that held all of our material possessions towards Alberta I had no way of knowing that during my time at the University of Alberta I would also become directly involved in changes to high school science in that province.

Science education renewal in Alberta was concomitant with the Science Council of Canada and Canadian IEA studies. While other provinces in Canada and countries world-wide were still considering an STS approach to school science education in the mid and late eighties, extensive planning on the organization and content of STS science courses by science educators and Ministry of Education officials was in progress by the time I moved to Alberta. The reformation of science education in Alberta is significant because to date this region has made one of the first and longest efforts in Canada and internationally in effecting a change in secondary school science education towards an STS perspective.

Given the demonstrated difficulty in changing science education since World War II the cynic might ask why we might be hopeful during this latest round of reform. After four decades of involvement in attempts at change in science education, Hurd (1991b) has observed that attempts at change "have done more to stabilize an obsolete curriculum than to provide insight and guidance for realizing a new vision of science teaching" (p. 35). In a latter essay Hurd (1994) argues that "clearly, attempts to revise, reorder, restructure, reshape, and other forms of tinkering with curriculums [sic] now in place in schools will not prepare young people for adapting to the sweeping changes now taking place in our contemporary society" (p. 103). Hurd's sobering assessments presents a disturbing and difficult question: Is change possible in science education? Given the current crisis in science education, faltering conversation of modernity, and the scarcity of time left to humankind to deal with environmental issues, this question on the possibility of change is critically important. Through the chapters that follow I intend to address this question directly through an examination of the significance of recent attempts to change high school science education in Alberta. Our conversation on the topic of curriculum change in science education continues in Chapter 2 with the genesis and evolution of Science 10-20-30 in Alberta.

CHAPTER 2
CHANGE AND THE GENESIS AND EVOLUTION OF SCIENCE 10-20-30 IN SCIENCE EDUCATION CURRICULUM-DISCOURSE

Introduction: Science Education as Curriculum-Discourse

The word 'discourse' can be defined as a collection of what is said, written, or thought (Ball, 1990) and are usually presented through words or symbols for purposes of communication. A discourse is not a random collection of words and symbols; each discourse "order and combine words in particular ways and excludes or displaces other combinations" (Ball, p. 2). Rules define this formation and the presentation of a discourse. For example, rules guide how to ask a question, make a pun in English, or how a committee prepares a science education curriculum document. Of course, rules vary with the discourse. I am restricted through tradition, grammatical rules, strict university regulations and the like on how to present the dissertation before you. A different set of rules might govern our discourse if you and I were to visit at a local tavern! Most of the rules that determine discursive practice are anonymous, an inheritance determined in time and space through historical formations and a myriad of influences such as social, economic, and geographical factors (Foucault, 1969/1972).

The previous chapter reported the support at the Wood's Hole Conference for basing the reform of high school science curriculum on the structure of science disciplines. Kass & Blades (1992) suggest that

> in such a context, questions involving the form and nature of curricular knowledge were rarely regarded as matters for debate. Relationships between school curricula and various science disciplines tended to be viewed as straightforward and largely self-evident by both teachers and the public. (p. 3)

The assumption science education should reflect science disciplines effectively defined "who may speak and what can be said and asked" (Kass & Blades, p. 3) in science education reform during the fifties and sixties. This discursive practice provided a framework for the planning of events designed to have educational consequences for students, or the *curriculum* of science education (Eisner, 1979, Chap. 3). The curriculum-discourse of that era is reflected in texts such as school materials, interviews, and teacher workshop packages. Texts also arise from recent attempts at curriculum change in science education. In Chapter 2 these texts provide the basis for an exploration of the events and implications of the recent genesis and evolution of the high school science programs Science 10, 20 & 30 in the Canadian province of Alberta.

Attempts to portray developments in this science education curriculum-discourse face a dilemma of exclusion and inclusion: Which texts are important to the genesis and evolution of the discourse? Which are marginal? From which points in space and time should texts be chosen? The act of choosing makes an objective position impossible; any view of the science education curriculum-discourse in Alberta is necessarily a personal interpretation. A further complication in portraying a curriculum-discourse needs to be confessed. Any presentation on a curriculum-discourse itself forms a text that must also be part of that discourse. In our case, Chapter 2 contributes yet another text to the very curriculum-discourse it tries to portray. Since speaking adds to a curriculum-discourse, the possibilities for re-presenting a discourse are infinite. Now, with infinite possibilities for speaking about the genesis and evolution of Science 10-20-30 in Alberta, Chapter 2 could become very large! For the sake of our conversation and your patience, I have chosen what I believe are key texts to prepare a brief summary of the events in Alberta.

Of course, this presentation must be personal and limited, but it is also accurate and important for two reasons. First, it is important since any discourse on attempts at curriculum reform is important to providing a context for discussions on the possibilities of curriculum change. Educators in the Canadian province of Alberta were "ahead of any others in pushing ahead into new territory" (Orpwood, quoted in Lewington, 1992, p. A4) of STS science education. Given the urgency of curriculum reform in science education and the hope of STS science education, examining how the curriculum reform towards an STS perspective fared in Alberta should prove instructive. Second, the account I share is accurate because it has been developed through participant-observation research. I became directly involved in the science education curriculum-discourse in Alberta as an author of the introductory chapter of the textbook designed to support the new Science 10 course and through the employment with government agency responsible for education in the province, Alberta Education. Through the collection of documents, some only available through my contacts with Alberta Education personnel, I was able to develop a narrative of the evolution of Science 10, 20, & 30. The accuracy of this narrative was verified by my colleagues at Alberta Education through interviews. The role and importance of these interviews is presented in Chapter 3.

During my research as participant-observer in the curriculum-discourse of Alberta I also made regular journal entries that reflect on events in the curriculum-discourse. These notes provide the basis for me to continue sharing my personal narrative. In Chapter 2 this sharing allows you to understand how I came to be involved in the curriculum-discourse and how this involvement became a research project. In the two chapters that follow, I disclose through a continuing narrative how I struggled in my research to make sense of the evolution of the Science 10, 20 & 30 programs of study. Grounded in the particular experience of events in Alberta, the disclosure of this struggle to understand what happened in this science education curriculum-discourse leads to critical questions about the possibility of curriculum change in science education in our modern situation.

Vision and The Genesis of Science 10-20-30 in Alberta

> In Alberta, our science programs are being completely redesigned to meet the expectations of the policy statement on Secondary Education (1985) and the requirements of tomorrow's society. Alberta Education (1989b), Science, Technology, Society and the Curriculum, p. 5.

The Proposed Changes to High School Science Education in Alberta

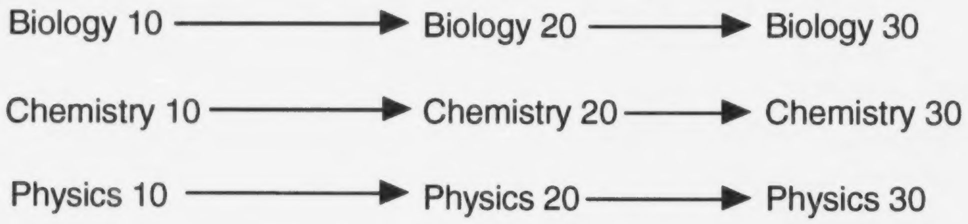
The Constitution of Canada allocated responsibility for the education of children to Provincial governments. Since there are differences in the education systems between provinces, I spent the first few weeks at the University of Alberta becoming familiar with the differences in science education between Alberta and my home province of British Columbia. Secondary school education in Alberta is divided into Junior High School, grades 7 to 9 and High School, grades 10 to 12. High School is also called Senior High School in Alberta. Successful completion of secondary schooling in Alberta depends on the accumulation of a certain number of credits earned with each passing grade in a high school course. A courses with a value of 5 credits usually have 100 hours of instructional time, those with 3 credits 70 hours of instructional time. Courses offered in high school are called 'Programs of Study' by the government agency responsible for schooling, Alberta Education.

During my first semester of studies at the University of Alberta I had the opportunity to attend a guest lecture by an official from Alberta Education. The

Alberta Education Program Manager for Junior High School Sciences began with a review of the Science Council of Canada study (1984) and the need for renewal in secondary school science education (B. Galbraith, Address to EDCI 370 Class, September 9, 1988). His points were familiar to me, I remember my general disinterest until he began outlining how Alberta Education was in the midst of a complete re-working of the topics, organization and focus of high school science programs towards an STS emphasis. After the presentation I met Mr. Galbraith and decided out of general interest to pick up a copy of the Interim Draft by Alberta Education (1988a) of the structure and content of a set of new science courses to be introduced in Alberta high schools, Science 10, 20 & 30.

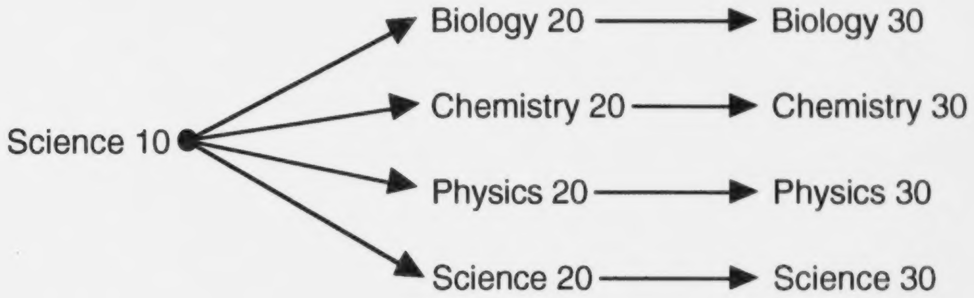
At first glance, the proposed changes to high school science education seemed merely organizational. Previous academic high school science programs in Alberta followed the traditional pattern and content of science education that arose from the American "alphabet soup" secondary school science programs developed during the 1950s and 1960s: Beginning in Grade 10 students in Alberta could choose sequences of courses based on the traditional science disciplines of Biology, Chemistry, or Physics (for example, Biology 10, 20, & 30) in order to develop the "conceptual frameworks and skills necessary for more advanced study in the specific fields of biology, chemistry, and physics" (Campbell, 1986, p. 2). Figure 1 below illustrates the organization of these high school courses in Alberta:

Figure 1. Existing high school science programs of study in Alberta.



Alberta Education proposed to replace the science discipline specialist courses at Grade 10 with a single, required science course initially called General Science 10; later this course was simply called Science 10. This single course substitute was proposed as a way to provide a smooth transition from studies in junior high school sciences while preventing a premature specialization of study in the sciences in Grade 10 that invariably selected against studies in physical science (Campbell, 1986, p. 5). From Science 10 students interested in a science-related career could enrol in courses which involve study of the science disciplines at advanced levels (for example, Chemistry 20 and 30), while students not intending a science career but still needing advanced academic credits in high school science could elect to enrol in the general science courses of Science 20 and Science 30. Figure 2 illustrates the proposed changes to the senior high school science program:

Figure 2. Proposed changes to the high school science programs of study in Alberta.



Looking over the Interim Program of Studies for Science 10-20-30 I realized my initial impression of these changes to high school science education in Alberta was wrong. Far more than an organizational shuffle, the Science 10-20-30 programs introduced a new set of senior high school science courses that stressed the integration of science disciplines with a focus on "the relationship between science and technology; an understanding of the relationship between science and its social context; the development of lifelong interests, intellectual curiosity, and the appreciation of science" (Alberta Education, 1988a, p. 2). In addition, the remaining courses in the science disciplines at the 20 and 30 level were to develop the same STS orientation as Science 10, 20 and 30. Clearly, Alberta Education was planning a massive overhaul of high school science education towards their goal of providing "science education for all students, under the umbrella goal of scientific and technological literacy" (Alberta Education, 1988a, p. 1).

The content of Science 10 demonstrates the extent of the changes proposed. Instead of selecting concepts from the previous Biology 10, Chemistry

10 and Physics 10 courses,[1] Science 10 was to be an entirely new program designed to "broaden the basis of science education by integrating into the science program accurate representations of the nature of science, the nature of technology, and their interactions with each other and with our society" (Alberta Education, 1989b, p. 5). A summary in Table 1 below of the topics in Science 10 presented in the 1988 Interim Program of Studies reveals the integrated, STS approach of this new science program.

Table 1. Summary of proposed topics for Science 10, September 7, 1988.

Unit 1: Body in Balance
Topics: reciprocal relationship of science and technology in the context of technological applications in medical science for the diagnosis, monitoring, treatment and maintenance of human body systems homeostasis.
Unit 2: Formation of Scientific Models
Topics: the generation and role of theory in science in the context of understanding major forces in nature; the use of models to support or illustrate theories (e.g. plate techtonics, weather forecasting, etc); the importance of theory and models in scientific prediction.
Unit 3: Importance of Water
Topics: Understanding the interrelationships of science, technology and society in the context of the chemical structure of water, water quality studies, and water quality management issues.
Unit 4: Personal Energy Systems
Topics: Understanding the importance of measurement and quantification in science and society in the context of input, conversion, and output in energy systems; the importance of energy efficiency, personal energy consumption, and energy needs in lifestyle choices.
Unit 5: Product Evaluation
Topics: Examining the nature of science through a scientific investigation of consumer products that includes a study of experiment design, organization, interpretation of data, assessment of research, considerations for further work and communications and conventions in science research.

The initiative from Alberta Education to develop current, relevant, integrated STS science education programs seemed to be a practical response to the growing crisis in science education reviewed in the previous chapter of this dissertation. In the fall of 1988 Alberta Education personnel presented an outline of new science programs to high school science teachers at the Alberta Science Teacher Conference held in Banff, Alberta. Part of my responsibilities at the University of Alberta included team teaching an undergraduate education course with a high school science teacher seconded to the Faculty of Education as an instructor in the undergraduate teacher education program.[1] These seconded teachers and professors in the Department of Secondary Education at the University of Alberta suggested attending the Banff Conference would provide an excellent way for me to capture an overview of the changes to science education in Alberta. This proved to be good advice. At the conference I attended one of the presentations by Alberta Education personnel on the new science programs. I was struck by the infectious excitement of their presentation. While many Canadian provinces and countries in the world were talking about renewal towards an STS approach in high school science, changes were actually going ahead in Alberta.

---

[1] For a summary of the content of these courses, please refer to Appendix A.

Being new to this province, I felt somewhat outside their science education curriculum-discourse but later that evening I had the opportunity to visit with many of the people involved in the Alberta Education presentation. Most of the Alberta Education personnel I met that evening were high school teachers on leaves of absence to work full time for Alberta Education on the changes to secondary school science programs. It did not take much prodding to have them share what they described as their "vision" for science renewal. As our evening progressed, I realized that even before the results of the Science Council of Canada (SCC) study became public (1984) educators in Alberta had anticipated and already responded to the emerging crisis in science education curriculum-discourse.

The Genesis of Science 10-20-30

The vision for science education renewal in Alberta was born during the early eighties amidst discussions in Canada and world wide about the content and organization of an STS approach to science education. Already by the mid-seventies locally developed programs in Canada such as Science, A Way of Knowing (Aikenhead & Fleming, 1975) and the ALCHEM modules (Author Group, 1972-1977) presented studies in science from an STS approach. Fensham (1988b) notes that the ALCHEM modules includes many of the features that were to be later considered part of an STS approach, making Alberta one of the first sites in the world to where STS science programs were developed. One of the authors of the ALCHEM series recalls that these early programs demonstrated that "you cannot handle social issues in a classroom without having some knowledge of the nature of science" (Interview with a Secondary School Science Teacher, May 1, 1992).[1] The discussion papers generated as part of the SCC study (1980-1984) stimulated conversation among educators in Alberta about nature of science, technology, and "decision-making aspect of societal issues as it related to science and technology" (Interview with a Secondary School Science Teacher, May 1, 1992). In 1983 Galbraith, then Supervisor of Science with Edmonton Public Schools, and Popowich, the Associate Director of Mathematics and Science at Alberta Education published a paper on how the nature of scientific inquiry might be emphasized in schools (Galbraith, 1983). The following year science educators Roberts and Popowich, together with two educators from the Seeds Foundation,[2] argued for "systematically incorporating an understanding of technology into science education programs for all students" (Phillips, Popowich, Roberts, & Westbury, 1984, p. 4). This recommendation was reinforced by the publication of the recommendations of the SCC in 1984 and supported in the Alberta Government White Paper, Proposals for an Industrial and Science Strategy for Albertans- 1985 to 1990 (Government of Alberta, 1984; see pp. 24-25). That same year two educators at the University of Lethbridge, Alberta proposed the best vehicle for STS science education would be a "unified science approach for grades 7 to 10" with "specialization in the traditional physics, chemistry and biology content areas be restricted to grades 11 and 12" (Butt & Mokosch, 1984, p. 37). In their paper the professors recommend Alberta Education develop a "separate science program route" (p. 37) for the "academically capable but non-science oriented students" (p. 37).

---

[1] At the University of Alberta's Faculty of Education, exemplary classroom teachers are able to spend one to two years sharing their expertise by teaching undergraduate courses in education.

The opportunity for Alberta Education personnel to develop just such a program came quickly. In September, 1984 the Premier of Alberta announced a review of secondary education in the province. Through questionnaires, polls, invitations for contributions and contributed papers all secondary education school programs were examined in a public forum (Alberta Education, 1989a). The review discovered "no agreement on any one particular science" (Government of Alberta, 1985, p. 8) among the people of Alberta. Without consensus about the direction of the new programs, decisions about the content and orientation of science education was assumed by Alberta Education. One Career Associate with Alberta Education,[1] recalls how the secondary education review process worked in science education: "What they did is put together a group of people to look at the courses in depth" (Interview with a Career Associate with Alberta Education, November 19, 1991, p. 3). Composed of mainly school science teachers, this group, together with the Alberta Science Education Consultants Council[2], presented to the Minister's Advisory Committee of the Secondary Education Review a position on science education renewal arising from their "observations of many classrooms, discussions with teachers and administrators and gleanings from professional literature and reports" (Alberta Science Education Consultants Council, 1985, p. 1). Both groups recommended renewing high school science towards an STS approach and reorganizing the high school science program to include general science courses at the 10, 20 and 30 level.

---

[1] Various individuals involved in the science education curriculum-discourse were interviewed as part of the research for this dissertation. Only individuals granting permission to use their interview comments are quoted in this dissertation. To protect the anonymity of the individual, general titles, such as "secondary school science teacher" or "career associate with Alberta Education" identify of the person interviewed; some individuals have the same title, in these cases different interview dates correspond to different individuals. A complete discussion of the ethics of interviewing and the need to ensure anonymity is presented in Chapter 3.

[2] Society, Environment and Energy Studies Foundation, an educational publishing company in Edmonton, Alberta. Phillips is the program director, Westbury the executive director of the Foundation.

In June, 1985 the Alberta government policy statement based on their review of secondary education, Secondary Education in Alberta, (Government of Alberta, 1985) gave legal impetus for the adoption of the changes recommended by the Alberta Science Education Consultants Council and science education review committees within Alberta Education. In the discussion on the credit requirements for graduation, the policy statement announces a three-course sequence of General Science courses for high school (Government of Alberta, 1985, p. 24). The introduction of General Science 10-20-30 to the schools of Alberta was now official government policy.

---

[1] This general title is used for all individuals working full time for Alberta Education. See previous footnote concerning the uses of these titles to protect anonymity, page 50.

[2] A loose organization of representatives from universities and professional groups in Alberta interested in the content and organization of high school science education.

The Development of Science 10-20-30 as a Modernistic Technical-Rational Act

> Curriculum development is a practical enterprise- not a theoretical study. It endeavours to design a system to achieve an educational end.
> Tyler (1975), Specific Approaches to Curriculum Development, p. 18.

Prior to 1985 renewal in science education was a vision within the science education curriculum-discourse of Alberta. This vision added an exciting dynamic to this curriculum-discourse as fundamental questions appeared: Should all students in high school study science? How can students develop the science literacy through science education to be prepared for the challenges of the next century? What innovative, radical forms could science education become?

With a legal mandate to develop General Science courses for high school the curriculum-discourse of science education in Alberta became more centred on questions of content and course structure. The vision focused on issues of practical concern: What will the new high school programs look like? How many credits should the new courses have? Alberta Education had a structure in place for dealing with these questions. Through the formation of Program Sub Committees, curriculum change is approached at Alberta Education as a rational, sequential process that follows the steps of needs assessment, initial proposals, course outlines, content standards, piloting of the new program, and subsequent revision as needed, leading to implementation in schools and evaluation of program success (Alberta Education, 1986a, pp. 3-10; Palmer, 1989a, p. 10). In this pattern curriculum becomes "an organized pattern of proposed study which identifies what is, and to whom it is, to be taught" (Tri-Partite Committee on Inservice Education, 1980, p. 5); this is, guides and textual materials that are designed, implemented, and evaluated. You will recall from Chapter 1 (page 18) the definition of curriculum as textual materials was one of the key assumption of the American science education curriculum reforms of the sixties.

This similarity in assumptions is not coincidental; the science education reforms of the sixties and the attempt to renew science education in Alberta closely follow a model of curriculum change that was made popular in 1949 by Tyler. According to Tyler's Basic Principles of Curriculum and Instruction (1949), change is a problem of scientific management involving identification of learning objectives, selection and creation of appropriate learning experiences, organization of learning experiences to achieve maximum effect, and evaluation of the curriculum on a continuing basis to ensure necessary revisions and improvements. Fractionating the process of curriculum change into manageable steps, suggests Tyler (1975), allows the change to be carefully monitored and controlled, ensuring success.

Foundational to Tyler's model is the conviction that a theory of curriculum change determines curriculum in practice. From this position, discourse on curriculum change is occupied with matters of technique, concerned with questions about the correct instruments and organizational strategies required to ensure successful implementation of the curriculum change. Aoki (1988) argues this approach to curriculum change originates from human interest in "intellectual and technical control of the world" (p. 409). As we have seen in Chapter 1, the belief in the possibility of this control through a rational, systematic, scientific approach is part of Great Conversation of modernity.

Published just before the start of the massive attempts at curriculum reform in science education, Tyler's technical-rational approach to curriculum change (Aoki, 1985; Eisner & Vallance, 1974; House, 1979; Giroux, Penna, & Pinar, 1981) proved to be a timely, practical, and natural expression of the expectations of modernity in curriculum-discourse. During the decades that followed, Tyler's technical-rational model of curriculum change came to dominate curriculum-discourse in North America (House, 1979; Walker, 1990). For example, the American National Science Teachers Association (1964) describe the task of curriculum change in science education as "primarily one of selecting and organizing ideas" (p. 33) exactly along the steps suggested by Tyler. Giroux, Penna, & Pinar (1981) note Tyler's book on curriculum change "became widely used in college courses on curriculum and also played an influential role in the theoretical development of the field itself" (p. 4). An entire genre of texts extending and refining technical-rational approaches to curriculum change were spawned from Tyler's little book, although they often extrapolated and added to Tyler's original work far beyond what Tyler intended in his rationale. In her text, Curriculum Development: Theory and Practice, Taba (1962) advocates a "systematic approach to initiating curriculum change" that adds the importance of diagnostic psychological testing to Tyler's original model. Joyce (1969) claims building "curriculum systems" (p. 176) in a school involves following a "set of tasks" (p. 176) that are an elaboration of Tyler's model. Gagné and Briggs (1974) elaborate on some of the psychological considerations involved in the choice and detailed sequencing of learning objectives in Tyler's model. Nicholls & Nicholls (1972) suggest curriculum development should begin with a "situation analysis," (pp. 21-31) then follow the exact steps proposed by Tyler. Tyler's model occupied such a central position in curriculum theorizing during the sixties and seventies that Tanner and Tanner (1980) claim this model was paradigmatic in curriculum-discourse.

Extensive building and elaboration of Tyler's original work led to the identification of curriculum change in a technical-rational model as a somewhat cyclical process of curriculum design, development, implementation, and evaluation (Joyce & Hersh, 1983; Hunkins, 1980; Oliva, 1982; Zais, 1976a, 1976b). Based on the premise that theory directs practice, technical-rational approaches to curriculum change support a process of "the output of a 'curriculum-development system' as an input into an 'instructional system' " (Johnson, 1981, p. 76). This output-input practice of curriculum change invariably seems to lead to the assumption of responsibilities for curriculum development, implementation and evaluation by a centralized agency, most often government Ministries of Education. For example, in the Canadian province of Saskatchewan the Minister's Advisory Committee on Curriculum and Instruction Review (1985) recommended a model of curriculum change where the government agency of Saskatchewan Education coordinate the evaluation, design, implementation and maintenance of new school programs. A technical-rational approach to curriculum change is clearly reflected in the Alberta Education monograph Who Decides What Students Should Learn in School... and How? (Palmer, 1989a). This publication suggests curriculum reform should follow a logical progression which begins with a provincial needs assessment and initial centralized development of a program of study by Alberta Education and then progresses through a series of field evaluations which lead inevitably to the authorization, implementation and maintenance of the intended change. Eventually the curriculum must be replaced and the process begins anew. The very titles of Alberta Education personnel suggest a strongly centralized, technical-rational orientation towards curriculum change in Alberta's provincial government: Program Managers, Program Developers, Implementation Consultants, Implementation Agents, and Subject Coordinators have worked within divisions of Alberta Education labelled Curriculum Design and Curriculum Support.

Given the predominance of technical-rational approaches to curriculum change in education-discourse, it seems perfectly natural that curriculum renewal of science education in Alberta was a technical-rational act. An Action Plan was developed at Alberta Education that predicted "a general science course will be implemented in September 1988. Courses for Grades 11 and 12 will follow" (Alberta Education, 1986b, p. 3). That year Campbell was hired by Alberta Education as Program Manager for Senior High School Sciences and Galbraith hired to oversee changes to Junior High School Sciences. In his paper, Proposal for Change- Senior High School Science, Campbell (1986) outlines how high school science education could move toward "a more contemporary and integrative focus" (p. 2) through the introduction of the General Science 10-20-30 sequence and a re-working of the content and orientation of science discipline courses at the 20 and 30 level. To engineer these changes several curriculum design committees were struck each charged with the task under Campbell's leadership to (Alberta Education, 1987a):

> 1. Select content statements, curriculum specifications, and criteria for resource selection.
> 2. Select initial learning resources for field testing.
> 3. Develop curriculum guides and other related documents. (p. 1)

This was the task facing the General Science 10-20-30 Sub Committee when they first met at Alberta Education offices on February 3 & 4, 1987. Composed of experienced high school science teachers and Alberta Education personnel, many who had once taught high school sciences, this committee met nearly every month in 1987. Already by the third meeting the fundamental ideas and topics that will form the content and credit value of the General Science 10, 20 & 30 programs of study were identified (Alberta Education, 1987b, p. 4). By May, 1987, the topics that would appear in the 1988 Interim Draft of Science 10-20-30 were chosen by the General Science 10-20-30 Sub Committee. Since General Science 10 was to replace studies in Biology, Chemistry and Physics at the 10 level, some committee members felt General Science 10 should introduce these science disciplines, however Campbell was able to successfully argue for an integrated, STS approach to Science 10, 20 & 30 (Alberta Education, 1987c, p. 3). An STS emphasis in the development of all high school science programs became official policy in Alberta Education's second draft of the Essential Concepts, Skills and Attitudes for Grade 12 (Alberta Education, 1987d, see especially pp. 12-14). The structure of changes to high school science, including replacing science discipline courses at the 10 level with General Science 10 was given further support by the Alberta government with the June, 1987 publication of the new graduation requirements for senior high school (Alberta Education, 1987e). At that time, all high school science courses, including General Science 10, 20 & 30 were designated as having a value of 5 credits; that is, they were all considered full courses in science education that could be used to meet graduation requirements. As we shall see later and in Chapter 4 of this dissertation, credit allocations became important in the evolution of the science education discourse of Alberta.

Through these committee meetings two problems in the development of the senior science program emerged. First, text resources to support the topics and integrated nature of Science 10, 20 & 30 (the prefix "General" being officially dropped in 1988) simply did not exist. The Sub Committee decided to employ the services of a publishing company to produce text materials custom designed for the new Science 10, 20 & 30 programs. Some Committee members expressed concern about having enough time to produce and disseminate such a text by the pilot of the new programs, now scheduled for fall, 1989 (Alberta Education, 1988b, p. 3). Campbell explained how this short time line for producing a custom text should not pose a problem since feedback in the pilot stages of the curriculum implementation would give a publisher nine months to publish the text (Alberta Education, 1988c, p. 3)! On May 13, 1988 the Sub Committee for Science 10-20-30 chose Gage Publishing (Canada) to custom design textbooks and teachers' guides for the Science 10, 20 & 30 programs.

The second problem was a consequence of the Alberta government including Career and Life Management (CALM) programs in high school. Accommodating the new CALM program required adding credits in an already tight high school program; room simply did not exist for the CALM courses. Representatives of instruction in the Fine Arts were complaining changes in science education forced students to study more science than ever, resulting in "less time for fine arts options" (Bexon, 1989, p. D6). This credit crunch, as it came to be known at Alberta Education, led to the decision by Alberta Education personnel that the best way to accommodate secondary school Fine Arts and CALM programs would be to cut the credit value of the science discipline courses at the 20 level to 3 credits from their original 5. Science 10, 20 & 30 and all science discipline courses at the 30 level would retain their original 5 credit value.

Meanwhile, the Science 10-20-30 Sub Committee met through 1987 and 1988 to finalize the Interim Program of Studies for Science 10-20-30 and to complete the specifications for textbook development. To help in the final selection of the content of the new science programs, draft outlines of Science 10, 20 & 30 were sent to schools with questionnaires that solicited feedback on these new programs. According to the Alberta Education Career Associate who categorized and summarized feedback returned by teachers, this so-called validation process was used to finalize the Interim Draft of the new science programs (Interview with an Alberta Education Career Associate, October 18, 1991).

By the fall of 1989 the curriculum specifications for Science 10, 20 & 30 were complete and it was generally agreed at Alberta Education that the "intent of the program [STS in Science 10-20-30] was coming through in the resource" (Alberta Education, 1988d, p. 3), that is the text chapters being developed by authors employed by Gage Publishing. From 1985 to the fall of 1988 Alberta Education personnel had followed a traditional, technical-rational approach to curriculum change. A committee had formed that met on a regular basis to select the learning objectives and content of a new curriculum. From design came development as curriculum guides and instructions for a custom-designed textbook were written. The new Science 10-20-30 program, and changes to science specialist courses at the 20 and 30 level, was one of the the newest expressions of an STS approach to science education at the high school level in North America. At the Banff Conference I could not help admiring the success of this curriculum development to date and I readily agreed with Alberta Education personnel that the implementation of the new program would likely proceed as smoothly. Imagine! In one year students in Alberta would begin to pilot the new integrated, STS Science 10 program, realizing a vision for science renewal that began years before! The confidence and excitement these colleagues from Alberta Education displayed that evening in Banff was understandable; but their predictions of an easy implementation of Science 10 was to prove premature.

Controversy and Crisis in the Evolution of Science 10-20-30

La théorie, c'est bon, mais ça n'empêche pas d'exister.[1]
Advice to Freud by Charot, French psycho-analyst.
From Gay, P. (1988), Freud: A Life for our Time, p. 51.

Destiny and the Discovery of Events in the Evolution of Science 10-20-30

I found the changes to high school science education in Alberta fascinating, but I lost track of the developments in the evolution of the new programs as I began a new semester of studies at the University of Alberta in January, 1989. I had become addicted to studies in philosophy, constantly turning in my mind the implications of classic works by Descartes, Rousseau, Locke and others to curriculum change. With the advice from professors in my department of Secondary Education at the University of Alberta, I began to read more contemporary philosophers, especially the works of Heidegger. At that time I shared an office with Carl Leggo, a fellow graduate student and brilliant scholar. Carl and I spent many, many hours discussing an essay by Heidegger, The Question Concerning Technology (1954/1977). I found Heidegger's rather cryptic style daunting, but through discussions with Carl and seminars in hermeneutics I began to make sense of Heidegger's essay and my other studies in modern European philosophy.

As I dove further and further into depths of philosophy, destiny intervened in the guise of opportunities. A professor of science education and research in our Department was working at that time as a special adviser to Gage Publishing. I was invited to write my impressions of the Science 10-20-30 initiatives, which this professor then sent to the editor with Gage Publishing responsible for the Science 10-20-30 series. The editor liked my ideas and writing style, and in February, 1989 I was offered a contract to rewrite the introductory chapter for Visions 1, the new textbook resource designed to support the Science 10 program.

I had begun keeping a personal journal of my experiences since coming to the University of Alberta. In my journal I note that I discussed taking on this contract with Heidi Kass, a professor in my department. This professor thought the offer was a wonderful professional opportunity that would be a learning experience; a prophesy that proved to be very accurate, indeed! I accepted the contract and in-between my studies I began to address the question: What might the introduction to an integrated, STS, academic science course look like? A journal entry (March 25, 1986) records that through writing the introductory chapter "I became immersed in the curriculum change." With this entry I had become both participant and observer in the science education curriculum-discourse in Alberta.

---

[1] Theory is all well and good, but this doesn't keep things from existing.

Participant-observation research is a particular type of research methodology in which the researcher "studies an organization or group by becoming, as much as possible, a part of the organization or group" (Rubin, 1983, p. 336; Schofield, 1969; Simon, 1969). By becoming a member of the team writing the textbook to support the new Science 10 program, I became a participant in the science education curriculum-discourse of Alberta. Through regular journal entries and through the collection of documents I also became an observer and recorder of the events in the science education curriculum-discourse. At the beginning of this research my journal entries were anecdotal since I had yet to appreciate my location as observer and participant in the curriculum-discourse. As events unfolded in this discourse, my research became a more focused project as I endevoured through interviews to "understand the perspective of group members; how they view themselves, their purpose, their activities, and those with whom they deal" (Kurz, 1983). The purpose of these interviews, journal records, document collection and the development and goals of this participant-observation research project is explained in Chapter 3. At the beginning of this research project I realized that to increase my understanding of the events in the evolution of Science 10, 20 & 30 I would need to "adopt the perspective" of those directly involved in the design of the courses by "sharing in their day-to-day experiences" (Simon, p. 208). I did not have to wait long for exactly such an opportunity.

Around the same time I was offered a chance to write the opening chapter for Visions 1, my office partner Carl showed one of his friends a copy of the essay I had written about the new science programs. Carl's friend coordinated at Alberta Education a small group responsible for assessing whether curriculum documents, such as Alberta Education Programs of Study, matched expectations for childhood development. After reading my essay, Carl's friend advised me of a new opening with Alberta Education in the area of assessing curriculum documents for someone with curriculum experience. The position sounded challenging and flexible enough to allow my continued studies at the University of Alberta; on April 18, 1989 I started working part time for Alberta Education as a Curriculum Validator.

Lunch meetings and coffee breaks at Alberta Education provided excellent opportunity for a novice to gain an appreciation of the inner workings of a government ministry. In this way I was able to move from "the status of stranger to friend" (Lather, 1986) in my research act. Through lunch meetings and the myriad of documents that passed my desk at Alberta Education almost daily, such as newspaper clippings, internal memos, copies of Alberta Education news releases, and minutes of meetings, I began to form and re-form views of the organization I worked for. I was most impressed with the dedication of the people I worked with at Alberta Education; everyone I met genuinely cared about the welfare of children in Alberta and expressed in words and deeds strong commitment to make the education system in Alberta the best possible. I realized Alberta Education per se does not really exist; for example, a document is not authored by Alberta Education, but the people who work within an institution called Alberta Education. The importance of this distinction is discussed in Chapter 3.

A rather dark, sombre mood prevailed among my colleagues at Alberta Education who were working on the new science programs. Various documents circulating our Branch revealed the new science programs, and in particular Science 10, were in deep trouble. Since I was a science educator with curriculum experience, members of Alberta Education involved in the development of the new science programs kept me abreast of recent developments. I listened with a sense of dismay to how events had conspired to defeat the optimism they had shared with me only a few months before in Banff. Their clear frustration left me wondering what had gone wrong.

My interest in the evolution of Science 10-20-30 became more serious with the recent turn of events against the new programs. I began collecting every document related to Science 10, 20 & 30 I could find through a somewhat archeological process that would have been impossible without the generous assistance of my colleagues at Alberta Education. Miles & Huberman (1984) suggest a "simple graphic structure" (p. 24-25) helps "assemble the key events during a particular time" (p. 26). I decided to follow this advice and prepared an events matrix from the documents I had gathered. An events matrix is a spreadsheet-like graphic that organizes information into time periods on one side and events along the other side. In a large room, I placed all the documents I collected into categories based on their source, such as reports in the popular press, comments from professional organizations such as the Alberta Medical Association, etc. A complete list of the categories I used is given in Chapter 3 (p. 106). The documents in each category were then arranged in chronological order in a row and I recorded the main points of each document in the row. Finally, the rows of documents were matched chronologically into a fairly large events matrix based on time and document category. I used this matrix to prepare a detailed chronology of the events in the science education curriculum-discourse of Alberta. When I shared my account of what happened to the Science 10-20-30 program with people closely involved in the evolution of these courses, I found the account a reliable narration of events. As Miles and Huberman (1984) had predicted, the preparation of an events matrix produced a "narrative, a story arranged in proper time sequence" (p. 122) that allowed key events, people and issues (Patton, 1990) to appear. These events, people, and issues become the subject of our discourse on curriculum change as we continue our story of the evolution of Science 10, 20, & 30.

Controversy in the Science Education Curriculum-Discourse

The first public murmurs of discontent about changes to the high school science program in Alberta after the Banff conference came from high school science teachers. In an article in the Alberta Science Teacher Wereley (1989), a high school physics teacher in Calgary and co-founder of the Alberta Association of Physics Teachers, argues the reduction of Physics 20 to 3 credits from 5 is a "serious threat to physics teaching in Alberta" (p. 16). Concerned that physics "will not be afforded any coherent treatment in this Science 10 program" (p. 17), Wereley suggests the decrease of instructional time for Physics 20 does not allow enough time for students to develop the knowledge and skills needed for Physics 30. Wereley calls on physics teachers throughout the province to send a "clear, unequivocal message to those who dictate curriculum content and emphases" (p. 18) that the changes proposed by Alberta Education are unacceptable in their present form. This call was answered: scores of letters were written to Alberta Education by high school teachers expressing concern over the proposed changes to the senior high school science program (Alberta Education, 1989a).

As a new year began, teacher organizations began to organize their protest against the proposed changes to the high school science program. Members of the Edmonton Regional Chemistry Council declared their concern over the reduction in credits for the 20-level discipline science courses at a January 12, 1989 meeting. At this meeting the suggestion was made that science teachers in the Edmonton area should meet to discuss the proposed changes. Over 75 science educators, including representatives from Alberta Education and post-secondary institutions, attended a meeting on January 26, 1989. Jenkins, then President of the Edmonton Regional Chemistry Council, reports that expressions at that meeting and subsequent feedback through questionnaires indicates the majority of science teachers "are opposed to a compulsory general science course and to a decrease in credits from 11 to 8 in the discipline streams" (Letter to science teachers by the Edmonton Regional Chemistry Council, March 13, 1989).[1]

Soon other voices were to join the science education curriculum-discourse. The education columnist for the Edmonton Journal, Olive Elliott, reported the objections of the Edmonton Public School system, one of the largest in Alberta, to the mandatory nature of Science 10; Elliott also made public the results of the questionnaire distributed at the January 26 meeting of Edmonton science educators, observing that "teachers are primarily concerned with the reduced emphasis on the specialized sciences" (Elliott, 1989, p. C2). Even before the Banff conference in the fall of 1988, the Dean and Associate Dean of the Faculty of Science at the University of Alberta felt concerns over the proposal to cut the credit value of 20 level science courses (Interview with Dr. Dave Beatty, June 11, 1991).[2] The Faculty of Science had formed in 1988 an ad hoc Committee to study and keep abreast of changes to the high school science programs. The Associate Dean of the Faculty of Science of the University of Alberta reports that members of this committee initially supported the idea of a General Science course at the 10 level, since this put "more physical science in the high school program" (Interview with Dr. Dave Beatty, June 11, 1991), but when the Interim drafts of the new program (Fall, 1988) began circulating among the Faculty some members of the committee were "very concerned" with Science 10-20-30 (Interview with

---

[1] This change in credits was due to the decision by personnel with Alberta Education to allocate 3 credits each to Biology 20, Chemistry 20 and Physics 20 instead of the previous 5 credits each.

[2] Reference and quotes by permission, Dr. Dave Beatty.

Dr. Dave Beatty, June 11, 1991). When asked during the interview about the nature of their concerns, Beatty replied,

> Well, it [proposed Science 10-20-30 program] had very little science, it was a kind of pop science, program emphasis on technology-social science approach, but not much in the way of integrated science. Our understanding initially was Science 10-20-30 would be an integrated science of biology, chemistry and physics so students would get more of the physical sciences because of what was happening in the high school system; to meet the minimum 11 credits they were taking either Biology or Chemistry or likely just Biology to get the minimum credits [to graduate] and never physics.

The Interim Draft of Science 10-20-30 clearly demonstrates a different program of study than the Dean, Associate Dean and other members of the Faculty of Science at the University of Alberta expected. In January, 1989 Beatty contacted the editors of the weekly magazine Alberta Report about his concerns over changes to the secondary school science program in Alberta. In February, 1989 the Faculty of Science at the University of Alberta declared Science 30 unacceptable for admission to science courses in their faculty, destroying the academic acceptability of Science 30 at the University of Alberta. In the ATA News deLuna (1989a) reports the University of Calgary accepted Science 30 for entrance requirements, except for admission to the Faculty of Engineering, while the University of Lethbridge was still undecided, although deLuna quotes University of Lethbridge Vice-president Newbold as unhappy with both the interim draft of Science 10-20-30 and the "lack of meaningful input [into the program] from the science people in universities" (p. 6). Responding to a request from Cammaert, then Associate Director of the Curriculum Design Branch of Alberta Education, to review the draft program of studies for Science 10-20-30 the University of Alberta Faculty of Science ad hoc Committee on the Proposed Revision to the High School Program (1989) presented a scathing condemnation of the proposed Science 10-20-30 program:

> The proposed Science 10-20-30 is not a good general science curriculum. It is a sequence of relatively isolated topics devoted to a selective technological application of science and the current social issues of this technology. The result is social science masquerading as science...Social science must not unduly dilute the science in these courses...we are concerned with the "watering down" of science in the school system. This dilution will result in a generation of individuals who will be deficient in basic knowledge skills at a time when the impact of science on everyday

> life is increasing greatly in both positive and negative ways. We believe it to be the very antithesis of the goals of secondary education. (pp. 2-4)

In the midst of this growing discontent, Alberta Education personnel were still predicting Science 10 would be implemented September, 1990, although the caution that "controversy may delay the program of study" was added (Alberta Education, 1989c, p. 3).

This prophesy was well founded. By March, 1989 the President of the Alberta Teachers' Association Science Council publicly complained in the ATA News that the new science courses disadvantage Alberta students intending post-secondary study in science (deLuna, 1989b, p. 6). That same month high school science teacher McGeachy published a stinging editorial in the Alberta Science Teacher. Describing the Science 10-20-30 program as a "Reader's Digest" science curriculum (p. 2), McGeachy (1989) claims the implementation of Science 10-20-30 leads to no less than the "death of science in Alberta" (p. 2). In the same issue, Armstrong (1989) argues the removal of Physics at the 10 level and the drop of science discipline courses at the 20 level to 3 credits as no less than the deliberate sabotage of the high school science program by Alberta Education! Armstrong chides that "perhaps the greatest single triumph that can be credited to the planners of the new curriculum is that the present program, with all its admitted weaknesses, has never looked so good" (p. 11). To the rhetorical question, 'Who wants the new program?', Armstrong concludes that "the only group supporting this new science program are civil servants in the Department of Education" (p. 11).

It certainly seemed that way by March, 1989. Over six hundred solicited and unsolicited submissions to Alberta Education indicated the proposed changes did not have the support of many high school science teachers (Alberta Education, 1989a; deLuna, 1989c, p. 3). Reviewing some of the responses, I was struck with how most called for reconsideration of the proposed changes. Without the support of the Faculty of Science at the University of Alberta and high school teachers in Alberta, the proposed changes seemed doomed. Matters were exacerbated by the failure of some authors working for Gage publishing to capture in their writing the STS intent of the new programs. I was relieved my introductory chapter was well received, in fact the reviews of this chapter from Alberta Education were positively glowing: "Excellent effort! Author has clear idea of the science, technology, society perspectives and develops them well" (Alberta Education, 1989f, p. 1).

On April 3, 1989 Dinning, the Government of Alberta Minister of Education, informed school boards throughout Alberta of the decision to delay the implementation of the new Science 10-20-30 program. In an article appearing in the ATA News, deLuna (1989c) reports Dinning felt the delay was needed to provide more opportunity for university personnel to react to draft programs, expand service offerings to help prepare teachers for the new courses, and give more time for the development of the Visions 1 resource, although editors with Gage had not requested the extra time. Understanding the political pressure on the Minister at that time, the delay seemed a wise way to stem growing controversy over the proposed changes.

But even with the announcement of delay the tide of controversy continued to rise almost exponentially as the science education curriculum-discourse in Alberta became increasingly public. Through interviews I discovered that early in 1989 a high school science teacher and a member of the Faculty of Science at the University of Alberta separately chose to contact T. Byfield, editor and publisher of the news magazine, Alberta Report, about the lack of support for the new high school science programs. The June 13, 1989 issue of the Alberta Report carried an article on the "Death of Science" in Alberta (pp. 23-24) that summarized how University professors and science teachers in Alberta were allied in a "full-scale rebellion against Alberta Education's latest curriculum proposal" (Byfield & MacDonald, 1989a, p. 23). Publishing selections from the Faculty of Science ad hoc Committee report, the vitriolic articles by McGeachy and Armstrong appearing in the Alberta Science Teacher, and quoting a University of Alberta physics professor, the Alberta Report article paints a strong indictment against the changes proposed by the "educrats" (p. 23) working at Alberta Education. In an editorial appearing in the same issue, T. Byfield (1989a) claims the controversy should be enough to motivate the Minister of Education to "block what his bureaucrats are trying to do" (p. 44). Since the Minister is on record as being "committed to the new science curriculum" (Dinning, quoted in T. Byfield, 1989a), T. Byfield calls for the Government of Alberta to fire the present Minister in favour of someone willing to "consult others outside the department, not in it, to find out what kind of schools will enable Alberta to meet the competitive challenges of the 21st century" (p. 44).

Attacks from the Alberta Report became even more virulent in the next issue. The cover features a full page photograph of a sullen Jim Dinning framed with the title, "Dumbing Down- That's What Experts Say Jim Dinning is doing to Alberta's High Schools" (June 19, 1989). The feature article, "'Dumbing Down' high schools," (pp. 28-34) reports on the "growing army of critics" to the proposed new science programs, even citing a rumour that the "ultimate departmental aim is to entirely eliminate physics, chemistry and biology in the secondary school in favour of a 'broader approach' through general science courses mandatory for all students" (Byfield & MacDonald, 1989b, p. 28). Byfield and MacDonald identify the controversy surrounding the proposed changes as the "universalist approach" by Alberta Education on one side, which they interpret to mean the intention that "all students are to be taught the same courses and enabled, one way or the other, to pass them" (p. 28) and the "realistic" approach of university professors and teachers who "favour less demanding [courses] for general diploma students, but not at the expense of rigourous courses in physics, chemistry and biology for advanced diploma students, some of whom will go on to scientific careers" (p. 28). The assertions in the Alberta Report articles were a frequent topic of conversation among my colleagues at Alberta Education. I remember joining my colleagues for lunch when they were in the middle of discussing T. Byfield's blistering attack of Alberta Education that appeared in the city of Calgary, Alberta's daily newspaper the Calgary Sun (May 28, 1989) over "the wild stuff [that] has been going on in high school science programs" (T. Byfield, 1989b, p. 12) and his recommendation the public "cage those education monkeys!" (p. 12).

Program managers and Program Developers at Alberta Education tried to meet the criticisms over the proposed changes to the science programs that were expressed in the media and in letters sent to Alberta Education by appeasement. Gradually the original September, 1988 Interim Draft of the Science 10-20-30 program became modified to include more of the traditional topics from the original Biology 10, Chemistry 10, and Physics 10 courses. For example, by May, 1989 Unit 3 (The Importance of Water) of the Program of Studies for Science 10 began to include a greater emphasis on the chemistry of water and the inclusion of topics from the previous Chemistry 10 program of study, such as atomic theory. Unit 5 of Science 10 (Scientific Evaluation of Consumer Products) was completely redesigned to focus on topics of Newtonian physics from previous Physics 10 program of study, such as momentum and acceleration, with an examination of how products such as motorcycle helmets meet safety standards (Alberta Education, 1989d).

These changes did little to stay the momentum of controversy over the new science program. In the Legislative Assembly of the Government of Alberta Dinning was called to answer concerns that "the Minister of Education is somehow diluting the quality of science education such that we will be graduating students who will be functionally illiterate in the sciences" (Hansard Education News, 1989).[1] The exchange in the Assembly was reported in the June 26, 1989 issue of the Alberta Report, along with new public criticism of the changes to high school science programs by Currie, the director of the Alberta Chamber of Resources. In this article V. Byfield (1989a) notes Currie's concern that the changes in high school science will lead to a "severe shortage of competent engineers, geologists and scientists within 10 years, due to the "watering down" of high school courses and diversion of best students into other lines" (p. 30). While the logic of this claim escaped me and my colleagues at Alberta Education, a similar hypothesis was made public by the Alberta Medical Association (AMA). In their News Release of June 27, 1989 the AMA publicly called for the Alberta Government Minister of Education to delay the implementation of Science 10 and to enhance, rather than eliminate, the previous Biology 10, Chemistry 10 and Physics 10 programs of study. The News Release notes that in a letter to Mr. Dinning the president of the AMA predicted that changes to the high school science curriculum will "threaten the long-term future of Medicare and the care that will be available to our patients" (AMA, 1989, p. 1). This terrifying prospect would come about because, as Murray explains, "without a high quality science program, Alberta students won't be qualified to train for the allied health occupations at NAIT, SAIT, and the community colleges or to pursue medicine, nursing, and other professions at our universities" (p. 1).[2] This sensational News Release was reported in newspapers across the province and, of course, the Alberta Report (Byfield & Hutchinson, 1989).[3] In early July the other major daily newspaper in Calgary, the Calgary Herald, reported on a letter written by the Association of Petroleum Engineers, Geologists, and Geophysicists of

---

[1] Mr. Dinning's response was a good summary and presentation of the intent, direction and activity of the proposed changes.

[2] Northern Alberta Institute of Technology; SAIT is the Southern Alberta Institute of Technology.

[3] For example, *Edmonton Journal*, June 28 (Panzeri, 1989); *Calgary Herald*, June 28 (Ross, 1989a); *Medicine Hat News*, June 29 (Rogers, 1989); *Edmonton Journal*, June 29 (Dinning under fire...).

Alberta (APEGGA) to Alberta Education that strongly opposed the "watering down" of the high school science program (M. Byfield, 1989). In the fall of 1989, APEGGA went public with their criticism, arguing the new science programs could "damage Alberta's ability to train technical professionals" (Langford, 1989, p. 1). At a special meeting in Calgary, members of APEGGA went on record as officially "opposing the proposed policy of the department of education to reduce the amount of time allotted to the teaching of biology, chemistry, and physics in provincial high schools" (Hellfritz, 1990).

These announcements by the AMA and APEGGA touched a nerve in Alberta; many letters, editorials and articles condemning the changes began appearing in major Alberta newspapers.[1] Often these letters complain new programs water down or dilute science education; some letters were quite unflattering to personnel at Alberta Education:

> I feel strongly that our so called "professional" education administrators do not deserve that designation; being, that they made themselves the least-qualified, the most unenlightened and the most dangerous bunch of amateurs to be entrusted with the real improvement of educational standards. (Thomas, 1989, p. A6)

Fuel was added to the fire of complaints with essays, speaking engagements, and interviews by Freedman, a physician outspoken in his concerns about the new science programs. In his widely distributed essay intended for parents, The Science 10 Controversy Explained, Freedman (1989a) describes Science 10-20-30 as a "lower level alternative to the specialized 'academic' 10, 20 and 30 courses in Biology, Chemistry, and Physics" (p. 2). In an interview with the Alberta Report, Freedman admits he first alerted the AMA to the changes in science education, leading to the AMA News Release (Byfield & MacDonald, 1989c, p. 28). In a later letter to Alberta Education, Freedman also acknowledges he pressed the AMA to ask representatives from APEGGA to denounce publicly the proposed changes (Freedman, Letter to Alberta Education, September 8, 1989).

Dinning recalls the resistance to the proposed changes was so strong that by July he reached the conclusion that "the only way to move ahead was to stop and assemble a credible group" to review the high school science program (Interview with Mr. Dinning, May 15, 1992).[1] On July 25, 1989 the Alberta Minister of Education announced the formation of a Minister's Advisory Committee to review the proposed changes to the science program with a tentative report date of February, 1990 (Alberta Education, 1989e). The purpose of this Advisory Committee, composed of representatives from Universities, Technical Colleges, APEGGA, ATA, and school districts was to provide advice of "policy and issues that affect science programs for Grades 7-12" (Ross, 1989d, p. B3) although the actual focus of Committee meetings was the new science programs for high school (Interview with Mr. Dinning, May 15, 1992).

---

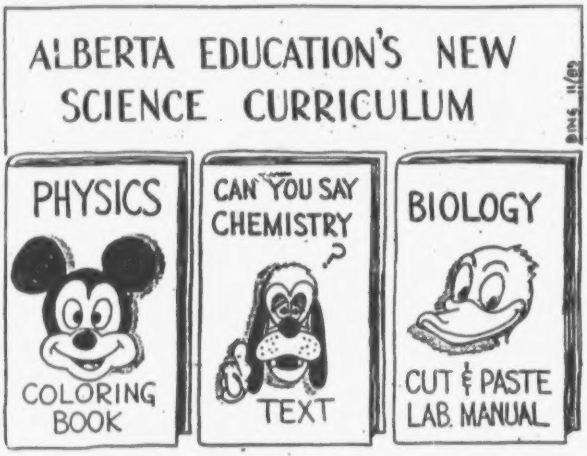
[1] Titles of these letters, editorials and articles indicate the discontent in Alberta. Examples include: Board wants changes delayed (Ross, 1989b), Science curriculum change no help to students (Blackman, 1989), Science changes worry (Lau, 1989), Science friction: proposed changes under fire (Ross, 1989c), Alberta student won't be able to compete (Andrews, 1989).

Even as the Committee met over the late summer and early fall of 1989, controversy over the new programs only increased while my colleagues at Alberta Education continued to defend the new program with enthusiasm arising from the conviction that an STS emphasis and science program modification was crucial to the citizenship of students. The August 12, 1989 edition of the major newspaper in the Alberta city of Red Deer, the Red Deer Advocate, carried a full debate on the new programs, with Freedman arguing the new science courses "are pulp" that contain content he describes as "pathetic" (Freedman, 1989b, p. 5A) while Panwar of Alberta Education counters on the same page that the courses "are not watered-down science" but programs designed to help students "understand how the scientific principles and laws affect our lives and community every day" (Panwar, 1989, p. 5A). Freedman sent copies of the debate to "every daily and the major weekly newspapers in the province" (Freedman, Letter to Alberta Education, September 8, 1989), sparking another flood of letters to the editor of newspapers and weekly magazines complaining about the proposed changes to the high school science program. One of the few positive letters that appeared during this time was by a retired education professor who suggests the necessary concepts of science "can be treated more effectively in the kind of program which is envisaged in the science, technology and society stream than in separate disciplines" (Marean, 1989, p. C5). Still, even the encouragement to Alberta Education offered by this professor was dampened with his complaint later that the new programs are not integrated enough! (Marean, quoted in Ross, 1989e). The cartoon below that appeared in the November 25, 1989 issue of the major daily newspaper of the Alberta city of Medicine Hat, the Medicine Hat News, portrays public perceptions of the new science courses at that time.

---

[1] Quotes and reference used by permission, Mr. Jim Dinning.

Figure 3. Cartoon from the Medicine Hat News, November 25, 1989.[1]



From August, 1989 to December, 1989 further drafts of the Science 10-20-30 program were produced "with the assistance of science teachers and university professors" (Palmer, 1989b); although it was clear to everyone at Alberta Education by late fall, 1989 the new programs were in serious trouble. Compounding the development of the programs was the continuing trouble Gage Publishing was experiencing in pulling together the Visions 1 textbook for Science 10. Gage personnel complained the program of studies for Science 10 kept being modified by Alberta Education personnel, while Alberta Education personnel charged the authors of various chapters in the new textbook authors did not have the ability to place into writing the STS spirit of Science 10. I was out of province teaching during the summer months and totally unaware of the developments in the science education curriculum-discourse of Alberta during the summer of 1989. When I returned in early September, I found a very upsetting letter from Gage Publishing informing me that Alberta Education had recently rejected the introductory chapter I had written for being "too much like social studies" (personal communication, September 6, 1989). It seemed that now I too was experiencing trouble writing to the expectations of Alberta Education personnel.

---

[1] Used with permission of Mr. A. Toirier, Editor, Medicine Hat News.

Meanwhile, the Minister's Advisory Committee had met several times to discuss the future of the proposed new science programs. At a November 24, 1989 meeting of the Minister's Advisory Committee several options for the high school science program were considered. The Committee elected to retain the structural changes to the high school program, increase the credit values of discipline courses at the 20 level to 5 credits each, and completely re-examine the content of all high school science courses. With a January, 1990 Alberta Education News Release, Dinning made the decisions by the Minister's Advisory Committee public, adding that "teachers, post-secondary institutions, and professional groups" would be involved "in the next state of development of all the new science courses" (Alberta Education, 1990a, p. 1). To allow this consultative process full time for effect, the Minister also announced another one year delay in the implementation of the new science programs. The content of the original Science 10-20-30 program of studies was officially dead; the Minister's announcement paved the way for a new program which he promised would give "greater focus on the scientific concepts and skills fundamental to biology, chemistry, physics, and other sciences" (Alberta Education, 1990b, p. 2).

Many explanations of what went wrong in the development of Science 10, 20 & 30 have been advanced. Before continuing the narrative of the evolution of Science 10, 20 & 30 it will prove to be useful to our discussion on curriculum change in science education to consider the assumptions behind explanations of the turn of events in the curriculum-discourse.

The Barrenness of a Structuralistic Explanation of the Evolution of Science 10-20-30

> The theory of the meaning of change and the change process provides us with an underlying conception of what should be done.
> This guide to change enables us to locate specific factors, to observe how they work in concrete situations, and to explain why they function as they do, and with what consequences for school improvement.
> Fullan (1991), The New Meaning of Educational Change, p. 93.

Reflecting on the evolution of controversy in the development of Science 10-20-30 Dr. Bill Duke, then Deputy Minister of Education for the Alberta Government mused that some of the controversy was the result "of flawed consultation early on in the change process" (Duke, quoted in Eamon, 1989, p. 3).

Duke's analysis is structualistic, an approach that elaborates and extends technical-rational methods of curriculum change. Structuralism as a mode of analysis is based on the assumption that phenomena, including human interactions, display an "underlying structure, not too surprisingly, that is defined, in part, by relationships among their constitutive elements" (Cherryholmes, 1988b, p. 16). In the technical-rational model, structuralism as analysis becomes prescription when used to define policy and practice (Cherryholmes, 1987, 1988b). For example, Duke's assertion is based on his analysis of the structure of the curriculum-discourse in science education during the years of controversy; his analysis becomes prescription as Duke goes on to say that further consultation would prevent further controversy in that curriculum-discourse (Eamon, p. 3).

Structuralism as method and prescription in education curriculum-discourse is an elaboration of technical-rational approaches to curriculum change: relationships between teachers, principals, students and other members of the educational community are considered as part of the so-called factors that must be considered in order to derive strategies that lead to the correct formula for curriculum change. From this highly technical-rational approach, curriculum change is a matter of dealing with enough factors to effect the change, since the "more factors supporting the implementation, the more change in practice will be accomplished" (Fullan, 1982, pp. 56-57). Structuralist perspectives to curriculum change have dominated educational discourse on change since the mid-seventies. Carroll (1986), Crandall (1983), R. Doll (1986), Fullan (1977), Joyce & Hersh (1983) and Tessmer & Harris (1990) advance theories of curriculum change which involve detailed examinations of the structure of education systems in order to facilitate implementation of an intended change. Sarason (1982) argues change begins with the discernment of the "overt behavioural or programmatic regularities" (p. 4) of education systems. The prescriptive nature of structuralist methodology in discourse on curriculum change supports a managerial view of the change process. Murphy (1986) suggests successful change occurs when educators "manage situations so that many of the factors associated with a specific intervention are given consideration" (p. 17). Curriculum change will be successful, argues Goddard (1989), when the correct "initiating strategies" are tied to "managing a product" (p. 14-15). Newton (1991) suggests a change process which follows the phases of "adoption, implementation, institutionalization or continuation" (p. 3). Essential to this process, argues Newton, is an understanding of the structures of schooling.

Fullan's recent book, The New Meaning of Educational Change (1991) is representative of structuralist approaches to curriculum change. In this work Fullan elaborates on the factors that should be considered when attempting change. What insights does this text provide to help make sense of the evolution, or perhaps devolution, of Science 10-20-30 during 1988 and 1989? Few of those involved in the science education curriculum-discourse of Alberta during 1989 could argue with Fullan's observation that "real change involves loss, anxiety, and struggle" (p. 31). In addition, Fullan reminds us that often "people do not understand the nature or ramifications of most educational changes" (p. 36). Given the fear and uncertainty arising from change proposals, Fullan suggests the initiation of change must consider several key factors (pp. 50-64). Fullan reminds us these factors are not in any particular order, but represent a nexus of inter-connections and relationships that must be considered if the change initiation is to be successful. First, the quality of innovation must be considered (pp. 51-53). An application of this factor to the evolution of Science 10-20-30 might present questions about the extent Alberta Education personnel collaborated with members of the various Faculties of Science of Alberta's universities to ensure the quality of the new science programs. If the consultation had been broader at the beginning, perhaps the Report of the ad hoc Committee of the Faculty of Science at the University of Alberta may never have been written. Second, Fullan advocates access to information on the proposed changes and the establishment of a communication infrastructure to ensure this access (pp. 53-54). In Alberta, much of the communication of the proposed changes to secondary school science education was limited to conference presentations and selected workshops, the audience almost always teachers. Fullan's second factor suggests that involving the media right from the beginning in the support that existed for the intended changes Alberta Education personnel may have found the program considerably less challenged. For those with concerns, a "hot-line" might have been established, promising an open, public forum on the direction and content of the new science programs. Third, without the support of administrative structures, assures Fullan, change "never occurs" (p. 54). Instead of waiting for the reaction of public school boards, Alberta Education could have involved key spokespersons in these boards and Superintendents of Education in the curriculum design process, ensuring supportive stakeholders in the new programs. Fourth, Fullan acknowledges what Alberta Education personnel discovered in 1989: Community support is essential (pp. 56-58). Again, communication through the media to communities throughout Alberta may have allayed many fears and concerns about the proposed programs. During their many teacher workshops, Alberta Education personnel might have aided their cause of curriculum reform by inviting the general public to attend. Last, Fullan argues the implementation of a proposed change has a greater chance of success if the resources supporting the change are developed before the change is initiated. He notes that "just because it is a good and pressing idea, doesn't mean that the resources are available to carry it out" (p. 64). Perhaps if Gage were able to develop a really exciting, dynamic textbook and practical, innovative teacher's guide illustrating what students would be studying in the new program, opposition to the changes by teacher organizations may have turned to support. It seems reasonable, even natural that with more consideration of these factors mentioned by Fullan, and other factors suggested in structuralist approaches to curriculum change, the controversy surrounding the development and implementation might have been avoided.

The events that follow in the continuing narration of the evolution of Science 10, 20 & 30 reveal, however, that such a structuralistic interpretation of the events in Alberta is simplistic and suspect. These events demonstrate the barrenness of technical-rational structuralism, opening our conversation to consider other ways to understand possibilities for curriculum change in science education curriculum-discourses.

The Griffin Arises: The Reconceptualization of Science 10-20-30 in the Alberta Science Education Curriculum-Discourse

> It is a rare revolution that has been true to its initial vision.
> Sarason (1990), The Predictable Failure of Educational Reform, p. 8.

Reaction and Revision of the Science 10-20-30

With the January, 1990 Minister's announcement the entire science program would be reconsidered, Alberta Education personnel were able to start over, this time considering the factors they neglected during their first attempt at change in high school science education. From the announcement itself, Alberta Education personnel portrayed the development of the new Science 10-20-30 courses, and the new disciplines courses, as taking place through consultation with professional organizations, teachers, and the general public. Almost immediately, the Alberta Report (January 15, 1990) pictured a smiling Government of Alberta Minister of Education with the caption "A consensus on school science" on the first page. Byfield & Kubbish (1990) note the membership of the Minister's Advisory Committee was "something of a coup" (p. 26) and offer praise for the ability of this committee, which they note was chaired by the Minister, to reach a consensus in "record time" (p. 26). In an article in one of the major daily newspapers in the Alberta city of Edmonton, the Edmonton Journal, (January 27, 1990) Panzeri (1990a) suggested Dinning was receiving "applause where he once received criticism" (p. A8). Panzeri also reports the Director of Curriculum of the Edmonton Public Schools was "pleased with her preliminary look" (p. A8). The Letter of the Day in the February 8, 1990 issue of the Edmonton Journal praised the Alberta Minister of Education for being the "first Minister in many a moon to listen, and respond, to public criticism before introducing a new curriculum" (Forbes, 1990, p. A15).

During the first months of 1990 curriculum developers at Alberta Education began the unenviable task of building the science programs anew. One colleague at Alberta Education was impressed with a proposal by the American Association for the Advancement of Science (AAAS) that student science literacy is encouraged when science education is built on the major themes in science. The rationale of this premise is that "an understanding of a few thematic ideas" in science "is especially useful in thinking about how things work" (American Association for the Advancement of Science, 1989, p. 9). These and other ideas for rejuvenating science education by the AAAS are summarized in their Project 2061 initiative (American Association for the Advancement of Science, 1989). Drawing insights from the AAAS Project 2061, Alberta Education personnel involved in the design of the new science programs outlined six "conceptual organizers," or themes, that provide a "useful way to bring cohesion and unify scientific concepts" (Alberta Education, 1990c, p. 2). The six major themes in science that would be highlighted in the new science program are: change, diversity, energy, equilibrium, matter and systems. By the end of January the science development team at Alberta Education produced a tentative list of concepts and possible topics that reflect these six themes. Anxious to avoid past mistakes, the development team at Alberta Education immediately began touring the province to solicit feedback on their ideas for new science program.

The development team soon discovered, though, that "there was not a lot of constructive comments from teachers when given the opportunity" (Interview with a Seconded Associate with Alberta Education,[1] October 10, 1991) and of the "many that did respond, mostly they wanted everything in!" (Interview with a Seconded Associate with Alberta Education, October 21, 1991). The significance of this consultative act is considered more fully in Chapter 4; one noticeable effect was a general acceptance among teachers of the ideas proposed by the Alberta Education development team. The February 12, 1990 issue of the Alberta Teachers' Association newspaper, the ATA News, reports the changes introduced by Alberta Education has the support of President of the ATA Science Council. The President of the Alberta Teachers' Association was also quoted as being "pleased with the involvement of various groups in the development of the new curriculum" (Teachers cautiously..., p. 1) a process the President felt "should be used as a model for other educational issues" (p. 1).

Protest in the media over the science programs turned to praise as the new courses seemed to meet the approval of everyone, well almost. MacDonald (1990) notes in the Alberta Report the University of Alberta Faculty of Science was "pleased that professors have been promised to have more input" (p. 32) in the design of the new programs. Kubish and Byfield (1990) quotes the president of the Alberta Medical Association found the changes to the Science program "reassuring" (p. 26). Panzeri (1990b) reports that Baker, Assistant Superintendent of Curriculum for Edmonton Public Schools, felt the new programs represents "the best chance for a turn around" in science education (p. B3). Panzeri notes in his article that while Science 10-20-30 represent "science for the masses," the Minister has promised the new courses will be rigourous, guarantied with the addition of a mandatory diploma exam for Science 30.[2] In a later article, Panzeri (1990c) comments that Jim Dinning has proved "deft in a thorny portfolio" (pp. G1, G3), a man willing to listen to the people. A good example of the perception in the media of developments in Alberta's high school science education can be found in a feature on the new programs in Canada's national newspaper, the

---

[1] The general title "Seconded Associate" refers to teachers who, still employed with their school boards, elect to serve with Alberta Education, often for a period of two years. When their term is completed, these Associates return to their classroom teaching responsibilities. This general title is used to protect the anonymity of those seconded teachers working at Alberta willing to be interviewed about their involvement in the evolution of Science 10-20-30.

[2] Government administered final exams worth 50% of course standing are required for all 30 level academic courses in Alberta. An exam for Science 30 had been discussed at Alberta Education, but not publicly.

Globe and Mail. The article notes that much of the criticism over the first round of science courses rose from how "course designers glossed over basic principles and concepts" (Lewington, 1992, p. A4). This problem was rectified, the article reports, by the program designers going out to "get people's ideas for a completely new design" (p. A4). Orpwood, a director of the Science Council of Canada study, is quoted in the Globe and Mail article as observing that with the newest changes to their secondary science program, "Alberta is ahead of any others in pushing ahead into new territory" (Orpwood, quoted in Lewington, 1992, p. A4). These accolades were dampened somewhat by concerns from some educators in Alberta that the restoration of full credits for all science courses recreates a "credit crunch" in schools that may mean some students will have to spend an extra year in high school if they enrol in courses in the fine arts (Ross, 1990). One teacher was quoted as saying "I don't think science is everything" (p. A5), however in Alberta at that time this would have to be considered the opinion of a minority of teachers.

A Discussion Draft of a completely new Science 10-20-30 program was produced by Alberta Education in April, 1990. This overview of the new vision for science education introduces the goals of the new program, the six organizing themes and the expectations of attitudes, skills and knowledge for learners. Science 10 is sketched out; the themes of energy, matter and change were slated to receive emphasis in this course. These themes were translated into four units which existed in only a summary form in April as (Alberta Education, 1991):

> Unit 1 focuses on the role of radiant energy from the sun in sustaining life and driving weather systems. In Unit 2 the processes by which matter and energy are exchanged between living systems and their environment are studied, and change is illustrated by the growth of living organisms. Unit 3 investigates the changes in matter and energy that occur during chemical reactions. Unit 4 examines different forms of energy and the principles that govern energy transformations. (p. 5)

Certainly a sketch of the direction and content of the new Science 10 course was a relief to Gage Publishing. Faced with the daunting task of completely rewriting their draft chapters for the Visions 1 textbook, many authors, including myself, elected to accept payment for services to date and withdrew from the project. Gage was also reimbursed by Alberta Education for their expenses preparing a draft document that never became published. In this sense, both Gage Publishing and Alberta Education started anew on the Science 10-20-30 project during 1990. With pilot testing of Science 10 slated for fall, 1991 each organization had almost a year and a half to prepare their respective documents.

The April, 1990 Discussion Draft of Science 10 had been shared with teachers throughout the province; over 1500 response guides were sent out with 375 returned by individual teachers and 29 by groups. In addition, the science development team met with approximately 70% of all science teachers in the province. Through this consultative process personnel at Alberta Education found teachers generally agreed with the concepts and skills in this new Science 10 course, value knowledge as more essential than application in science education, and favour keeping the current content (i.e., themes) and sequence of the new science program (Alberta Education, 1991).

At this point in the story of the evolution of Science 10-20-30 a strange, almost isolated, event happened. Late in the spring of 1990 some of the personnel at Alberta Education responsible for the design of the Science 10 program met with a member of the university community to re-examine the Science 10 program of study. The agenda for this meeting, according to the member of the university community, was to pursue the question, "What would a general science course, intended for academically oriented tenth graders, look like?" (Interview with a Member of the University Community, May 29, 1992). The meeting became "very stimulating" due to the "number of ideas" that were shared (same interview). The meeting was also productive. One seconded associate with Alberta Education recalls that "a fine curriculum" for Science 10 was developed that that day (Interview with a Seconded Associate with Alberta Education, April 27, 1992). What emerged was a conceptual theme that linked together new topics and ideas in science into a "modern, contemporary course" that recaptured the original vision of the Science 10, 20, & 30 programs of study (Interview with a Member of the University Community, May 29, 1992; Interview with a Seconded Associate with Alberta Education, April 27, 1992).

Most of the individuals involved in planning this newest version of Science 10 were on summer holidays when the draft program of studies was shared with Gage publishing. A seconded Associate who was working at Alberta Education that summer recalls that Gage personnel were "infuriated" with "what they perceived as another change to the curriculum" (Interview with a Seconded Associate with Alberta Education, October 21, 1991) since the newest version was a significant change from the April, 1990 Discussion Draft they were using.

Meanwhile, the member of the university community involved in the design of the new Science 10 course experienced "increasing unease" as the summer wore on because this individual was not being sent "any written material in terms of the course" (Interview with a Member of the University Community, May 29, 1992). At the end of the summer this individual was rather surprised to discover that "the basic structure" of the Science 10 course "was revised rather drastically" back in line with the Discussion Draft of April, 1990 (same interview). The version circulated in August, 1990 seemed to this member of the university community as a science program of "essentially stand alone units with only token connections" in a program that "still represents outdated materials [and] outdated concepts" (same interview). Seconded Associates working on the Science 10 program that summer agree with this assessment, but claim they were unable to continue developing the Science 10 program proposed by the group that met in June, 1990. Not only were personnel with Gage Publishing upset with the latest changes, but senior Career Associates with Alberta Education also found the June draft "unacceptable" and requested those Seconded Associates available that summer to "re-work" the draft to the "specifications" of the April, 1990 draft (Interview with a Seconded Associate with Alberta Education, April 27, 1992). It was the expanded version of the April, 1990 draft that was to become the final program of study for Science 10, delegating the June, 1990 draft as a mere footnote in the narrative of the evolution of Science 10.

This odd incident seems significant to me, however. I have a copy of the June, 1990 draft of Science 10 proposed by the group that met that day. In my opinion, this version of Science 10 was more dynamic and more in tune with the interests of young people that even the original 1988 version of Science 10. As we shall see in Chapter 4, I believe the development, and subsequent rejection, of this new and exciting program for Science 10 late in the evolution of Science 10 is more than just an isolated incident in the science education curriculum-discourse of Alberta.

By late August, 1990 personnel at Alberta Education were able to produce a final draft of Science 10. This draft was based on the April, 1990 draft and became, with only minor modification, the official and final program of studies for Science 10 for the province. Work then proceeded quickly to develop the final versions of the Science 20 and 30 programs. At the annual meeting of the Alberta Science Teachers' Association in Jasper, Alberta in the fall of 1990, Panwar (1991) was careful to explain that this final version of Science 10, 20, &

30 "will achieve excellence by providing a more rigourous science education. This rigour will be achieved by helping students understand basic scientific concepts, principles, and laws and by the real-life applications of science and technology" (p. 8). He continued by assuring his audience that "the proposed Science 10/20/30 program is designed for academic students who want a strong foundation in science. Science 10, as a compulsory course, will give students a broader understanding of the important scientific concepts in biology, chemistry, and physics" (p. 9).

Gage had been busy, too. With a secure program of studies for Science 10 by September and a more concentrated author team, a draft outline of the Visions 1 textbook was available by mid fall, 1990. I was briefly employed that fall to review this draft for Gage Publishing and sent them ideas and materials some of which would come to be eventually incorporated into some of the chapters of Visions 1 textbook for the Science 10 program. I assumed this would be my last work for Gage Publishing, but in early 1991 I agreed to become involved once again in the science education curriculum-discourse by writing the Teachers' Guide for the completed new version of Visions 1.

What is the Meaning of Educational Change?

Plus ça change, plus c'est la même chose.[1] French Proverb.

The Lesson of Science 10

My narration of the evolution of Science 10-20-30 ends with the publication of the August, 1990 program of study for Science 10. This program of study proved to be the final version, after some 13 changes, of Science 10. A postscript, however, is in order. In the months that followed drafts of Science 20 and 30 were written that met that same general approval as Science 10. I remained involved in the curriculum-discourse as an enthusiastic supporter of the new programs, partially out of friendship with my colleagues at Alberta Education and because I believe, and still believe, that integrating the 10 level specialist courses into one course developed with an STS approach was a step in the right direction. In June, 1991 Alberta Education held workshops at the University of

---

[1] The more things change, the more it's the same thing.

Alberta to support teachers about to pilot the Science 10 in the new school year. In my involvement as a workshop leader I was struck by the enthusiasm for Science 10 displayed by most teachers. All of us knew the Science 10-20-30 initiative was alive when in October, 1991 the Faculty of Science at the University of Alberta approved the addition of Science 30 to the category of senior secondary school science courses, such as Biology 30, Chemistry 30, and Physics 30, graduating students may use for admission to the Faculty (Faculty of Science, 1991, p. 1). Conceived almost a decade earlier, Science 10 became a reality in the classrooms of teachers piloting this new science in September, 1991. The following year science specialist courses at the 10 level ceased to exist in Alberta; Science 10 was now in place in the secondary schools across the province of Alberta.

How are we to make sense of the genesis and evolution of Science 10-20-30 in the science education curriculum-discourse in Alberta? The original vision for science education in this curriculum-discourse focused on developing an STS approach that would help all children to become critical, scientifically literate citizens. This movement towards renewal was catalysed by the growing crisis in science education: declining student interest in science-related careers, poor enrollment and achievement in high school sciences, especially physics, growing concerns high school science was rooted in subjects too esoteric to a population worried about environmental degradation in the midst of increasing technological complexities in almost every area of life.

In 1990 I engaged several groups of students about to graduate from high school in long, deep discussions about their school science experience. My conversations with grade twelve students reveal the general disappointment students feel with the their senior high school science education (Blades, 1992a). I recall that Dede[1] found "all that cell stuff" she learned in Biology 10 to be "terribly irrelevant," (p. 10) a sentiment I found universally shared by the students interviewed. Sally's comment reflects a consistent concern among students about the usefulness of their science education: "For chemistry, I don't think I'm ever in my life going to need stoichiometry or stuff like that. I don't know... I can't even think of a job where you'd use it!" (p. 11). Every group of grade twelve students I met with expressed concern that their science education, especially topics in chemistry and physics, did not connect to their daily lives and may prove not relevant in the future. Dick described physics as "plugging numbers into a formula" but complained that he had "no idea how half the formulas work" (p. 11). Students would gladly trade highly quantified studies of Newtonian physics for more modern topics in physics, such as the existence of black holes and the theory of relativity. Students were able to list other topics they would like to study in high school science: the human body, environmental science, and the philosophy and history of science were a few of the topics mentioned. Many of these topics, and others identified by students during our meetings, are found in the 1988 Interim draft of Science 10. The vision that introduced this course to the public sprang, I believe, from teachers with ears open to the voices of their students, eyes open to the growing crisis in science education, and hearts hopeful they could really make a difference in this crisis with a program that would prove exciting and motivating to children.

---

[1] Not her real name. Students choose pseudonyms in this study to protect their anonymity.

This vision never had a chance. Over time controversy mitigated against the original draft until the program was re-worked and completely changed, appearing on the organizational skeleton of the former vision. Still, one could counter, everything turned out right in the end since the new programs have not only been 'implemented' in schools, but these programs have won approval from organizations previously antagonistic to the original programs of study for Science 10-20-30. From this perspective, personnel at Alberta Education simply failed to consider the necessary factors in implementing change first time around; the success of the revised program that appeared in 1990 indicates that eventually Alberta Education was able to get it right. Through the correct consultation strategies and sensitivity to the demands of academic and other organizations, Alberta Education was able to turn protest into praise. To this structuralistic interpretation I must reply with a summary of the final draft of the Science 10 program of study which appears below. I would invite you to turn to page 48 and read once again the summary of the original draft in Table 1, comparing it to the one that follows in Table 2.

Table 2. Science 10 Draft Course of Studies, August 31, 1990. (Alberta Education, 1990d)

Unit 1: Energy From the Sun
Topics: energy from the Sun sustains life on Earth, weather systems are driven by solar energy, calorimetry, thermal energy, the Coriolis effect, tornados, hurricanes, thunderstorms, hailstorms, chinooks, meterologic data, hydrologic cycle, water and phase changes, moderating effects of large bodies of water.
Unit 2: Matter and Energy in Living Systems
Topics: cell organelles, mitosis, diffusion & active transport in cells, ATP, photosynthesis (general terms), multicellularity, survey of transport, excretion and gas exchange systems in the biology of selected organisms.
Unit 3: Matter and Energy in Chemical Change
Topics: mixtures, solutions, compounds, physical and chemical changes, classification of elements, predicting properties of elements, types of chemical changes (synthesis, replacement, etc.), naming and writing formulae for selected compounds and chemical reactions, atom, isotopes, conservation of matter, stoichiometry.
Unit 4: Energy and Change
Topics: forms of energy, the Sun as the source of most forms of energy, units for energy (joule), KILOWATT/hr; conservation of energy, first and second laws of thermodynamics; energy transformation of energy, Newtonian physics, one-dimensional uniform motion using graphical and mathematical techniques, Work = F x D, E= VIT, formula for KE and PE; energy conversions and efficiency, interpreting empirical data, measuring input and output of systems.

A glance at the summary found in Appendix A of this dissertation of the topics in the previous Biology 10, Chemistry 10 and Physics 10 programs of study in Alberta confirms the fact that the final program of studies for Science 10 represents, with the possible exception of Unit 1, an amalgam of topics from Biology 10, Chemistry 10 and Physics 10. If renewal in science education means finding new ways to explore the relationships between science, technology and society in ways that are distinct from the approaches of science courses developed in the fifties and sixties; if renewal means pursuing topics and issues free from the shackles of traditional science education content, *then the attempt at change in science education in Alberta must be considered overall a failure*. The very fact University Faculties of Science applaud the new Science 10 course should raise suspicions little change has been accomplished: It was the familiarity of topics that made the new science programs so dramatically acceptable to teachers and professional organizations. Anyone steeped in a traditional view of high school science education could point to the first, 1988 draft of Science 10 and say, "Where is cell anatomy? Newtonian mechanics? Stoichiometry? We always teach those topics in grade ten!" The fact these topics were not present in the original Science 10 was deliberate; developers wished to present something new that might stimulate, rather than frustrate, the attitude of children towards science. Should we be surprised, then, that this approach was greeted with such scepticism? When rigour means calculating momentum, yield of chemical reaction or the ability to recite the steps of mitosis and meiosis, it's little wonder the original Science 10 was categorized as "diluted" science first by academics within University Faculties of Science, then through media characterization and professional organization involvement that was clearly a bandwagon effect.

This reaction was not unique to Alberta. Fowler (1990) reports how an attempt to change curricula in the Canadian province of British Columbia found similar resistance from teachers and academics, leading to vociferous debate through the media that eventually served to undermine the change attempt. Bybee's (1992) analysis of attempts in the U.S. to change science education towards an STS perspective reveals that "little is being taught about STS in school programs" (p. 81) and that a large gap still exists between talking about STS science education and actual cases of successful change. Certainly the newest round of reforms in response to the second crisis in science education have not enjoyed much success. British attempts to introduce STS science courses met with increasing centralized control as the new programs were labelled 'soft' by academics, leading to the expulsion in 1988 of science, technology and society from the national curriculum (Jenkins, 1992; Solomon, 1991 & in press). Fensham's study (1988a, 1993) of attempts at curriculum reform towards an STS approach in science education in the state of Victoria, Australia revealed the tremendous barrier to curriculum change imposed by academics, offering a reason for this resistance to curriculum change in science education at the high school level:

> The dominant academic response to the current reforms (and to those in the 1960s) is consistent with a strong sense of science education at schools as 'preparatory'. Thus, the content and knowledge of worth for the senior secondary sciences is to be determined by the knowledge and expansion of it that is now well established as the content of freshman science courses in physics, chemistry and biology... In the 1980s and 1990s freshman studies in physics and chemistry in particular have changed only slightly from the 1960s despite the major changes in these sciences as a whole in this period. The concerns of academic scientists about school science curricular [sic] are presently to *prevent* them from deviating from the smooth continuity their now traditional content provides. (Fensham, 1993, pp. 61-61. Emphasis his.)

Fensham's comments suggest any attempt at curriculum reform faces a formidable obstacle in the re-generation process of tradition. If this is the case, then structuralistic analysis and prescription would, in fact, ironically serve the maintenance of the status quo. This is exactly what happened in Alberta. Criticized for not consulting enough, which is a structuralistic interpretation of why the changes were so difficult the first time around, personnel from Alberta Education then tried to appease academics and other professional organizations through consultation and inclusion in Science 10 the science topics these groups expected in high school science. As traditional topics in grade ten science began to appear in the re-worked Science 10, the praise and approval of this new-yet-old science course by academics makes sense since, in effect, *nothing had changed* except the way in which these topics were organized at the Grade 10 level. And it pains me to say this, knowing a little of the heartache experienced by those who really believe, and still believe, in the importance and value of that first attempt at significant change in high school science education in Alberta.

The Barren History of Curriculum Change

Perhaps there is some consolation to those involved in the genesis and evolution of Science 10-20-30 in the knowledge that despite constant effort and millions of dollars, curriculum change has proven extremely difficult in practically every area of the school curriculum. Atkin (1989) summarized the mood of the end of the sixties and seventies as a time of diminishing optimism in the promises of curriculum reform. He notes that during the seventies "people began to notice that the prevailing models of educational research and scholarship were producing little noteworthy change in educational practice" (p. 202), a view supported by Fullan (1993), Stevenson (1973) and Wood (1990). Cuban's (1984) review of major attempts from 1890-1980 to reform American high school practice found little curriculum change actually occurred. According to Cuban, school practice and structure has remained amazingly uniform over these decades; in fact, claims Cuban, schooling seems to be a resilient social institution which is highly impervious to attempts at change despite the sweeps of reform that cycle through education in a cyclical pattern (Cuban, 1982, 1990). Common (1981) suggests Canadian education demonstrates a similar resiliency to change; she observes that after two decades of innovation from 1960 to 1980 there has been "so little change" (p. 42). This resilience to change is confirmed by Crocker's

(1982) research on two unsuccessful attempts to change science education curriculum in Canada. Sarason's latest book, The Predictable Failure of Education Reform (1990) poses a question that succinctly summarizes the poor record of attempts at curriculum change since World War II: Why, in the light of the fact that in the post-World War II era we have poured scores of billions of dollars into our schools, do we have little or nothing to show for it? (p. 3). Hurd (1991b), that veteran of many curriculum reform efforts in high school biology education, notes in a recent essay that "despite the turmoil over science education during the past decades, not much has happened" (p. 35). Reid & Westbury (1982) support this assessment, noting that the British and American science reforms of the 1960s experienced at best marginal success in actually reaching the classroom and in some cases the attempts at change "foundered completely" (p. 1).

The Determined Hope of Structuralism in Educational Discourse

As I reported earlier in this chapter, structuralistic analyses and prescription in technical-rational approaches to curriculum change has dominated educational discourse since the mid-seventies. Wise (1977) suggests that since "changes do not inevitably lead to the predicted result, perhaps there is something wrong with the rational model" (p. 49). Instead of examining the model itself, however, the failure of curriculum reform has been rationalized during the past decade as a problem of knowledge: change has *yet* to succeed because the correct techniques have not been fully articulated and then applied. To find the key to effective curriculum change, more research into the structural complexities of public schooling would be needed. Thus, the majority of educational research on curriculum change during the past decade has probed deeply into the structures and dynamics of schooling in an effort to solve the riddle of curriculum change, *leaving largely unchallenged the very presuppositions of this technical-rational approach to curriculum change.*[1] The result has been the entrenchment during the past decade of structualistic approaches in the technical-rational tradition of education. For example, Turney (1976) recognized that "most of our past effort at educational change has failed...because we did not realize the magnitude of the task" (p. 233). He then elaborates some of the factors that should be considered when initiating change. Crocker (1982) argues that successful curriculum change involves solving "the problems of different perspectives and of structural components of the school setting" (p. 35). Miller and Seller (1985) support Crocker's view, suggesting curriculum change involves a type of "transaction" between the players in the change during the steps of development, implementation and evaluation. Leithwood (1986) suggests the "solution to the problem of improving school effectiveness using the planned change approach is essentially the task... of facilitating organizational growth" (p. 6). This growth occurs, according to the author, through the familiar steps in the technical-rational model of curriculum review, development, and implementation. In a reflection on what he has learned about curriculum change, Fullan (1993) acknowledges that "it is one thing to have a list of factors, and another to know how these factors interact and unfold" (p. 120). Still, Fullan betrays his structuralist stance when he continues in his article to elaborate eight lessons from the history of curriculum change that "represents dilemmas, *with corresponding lines of action*" (p. 124, emphasis mine) arising from an understanding of the "*systematic reality* and dynamic complexity" (p. 124, emphasis mine) of educational change.

---

[1] Some significant challenges to scientific-managerial approaches to curriculum change were advanced from neo-Marxist approaches to education during the late seventies and in the past decade, but these challenges do not represent mainstream educational discourse.

Rethinking Curriculum Change

As the twentieth century comes to an end, technical-rational approaches to curriculum change, even with the elaboration of structuralism, will likely continue to prove barren in helping us find hope and possibilities for curriculum change. This prophesy is more than an extrapolation of the dismal history of attempts at curriculum change; the very presuppositions of the technical-rational act undermine the value of technical-rational approaches. Three assumptions in the genesis and evolution of Science 10-20-30 illustrate this irony:

1. Assumption of expertise

The original intention of people involved in the design of Science 10-20-30 was to produce a course of study that would engage all students in thoughtful study of the nature of science and the relationships between science, technology, and society (Alberta Education, 1989b). Over time the curriculum-discourse included the voices of academics and professional organizations. Representatives from these groups claimed the right to also determine the direction and content of the new programs, shifting expertise from the original design team to the public forum. The consequence was an "academic influence" (Fensham, 1993) in the curriculum-discourse that catalysed a shift towards emphasizing the expertise of non-education specialists in science education curriculum reform.

2. Assumption of curriculum

As was noted earlier in this chapter, the original vision for science education renewal in Alberta came to eventually focus on issues of the practical expression of ideas. In this natural progression definition of the word 'curriculum' moved from vision to materials. As early as January, 1989 'the curriculum' in the science education curriculum-discourse referred to the draft program of studies and developing Visions 1 textbook. For example, when Freedman (1989a) refers to the "new science curriculum for public schools" (p. 1) he immediately refers to programs of studies; this type of referring is constant among all the members of the science education curriculum-discourse at that time. The perception of curriculum as a document and materials to be used assumes curriculum is something developed external to the classroom then implemented, with the aid of teachers, into lessons. The focus on documents as curriculum shifted the science education curriculum-discourse at the time towards a view of curriculum change as a technical-rational problem.

3. Assumption of method

In this chapter we have seen how curriculum change in Alberta is approached as a task accomplished through the familiar steps of the technical-rational model: Assessment, design & development, implementation, and evaluation. As this approach began to prove unfaithful during controversy in the design & development stage of Science 10-20-30, people still clung to a technical-rational model by elaborating the factors to consider when the design and development was attempted once more. The results of this faithful trust in a technical-rational approach proved to be misplaced, however; the design and development of a new high school science program in Alberta turned out to be little more than a reorganization of traditional science topics.

You will recall from our conversation in Chapter 1 that these three assumptions are the same ones that were foundational to science education reform in the sixties (see pp. 18-19). This is not surprising; in each wave of reform *the same technical-rational model of curriculum change dominated the curriculum-discourse.* Neither should the failure of significant change in Alberta surprise us, for that has been the demonstrated legacy of the technical-rational model.

Some change in science education during the sixties was evident; new programs designed during that era *did* appear in schools in various interpretations, some no doubt close to what the people designing the new programs intended. We need to remember, though, that this is no longer the fifties and sixties. The hope and promises of modernity during those decades were unfulfilled; as Guiness (1979) observes in his critique of Western humanism, "rationalism and optimistic humanism have thus turned out badly, and so has the entire Western culture" (p. 35). In the midst of growing ecological emergency, exponential growth of technological knowledge, and failure of science and technology to solve our social ills, we in the West have become sullen (Borgmann, 1992), unsure of what we should know or what we should do. In this crisis of modernity, we are faced in education with a model of curriculum change founded on the very modern premise that change is possible through a scientific analysis of the factors needed to ensure the change. The case of the genesis and evolution of Science 10-20-30 in Alberta illustrates the irony of our situation: a new science program was designed to meet the crisis of modernity through a process that is fundamentally modernistic! Given this entrapment and our conversation on the evolution of Science 10, we might agree with Hurd's (1991b) assessment that

> breaking out of the intellectual strait-jacket and nostalgia that characterize traditional science courses will not be easy. We must begin from scratch. Little will be gained by simply revising and updating old subject matter, tinkering with the instructional system, modifying assessment techniques, or reorganizing institutions. (p. 35)

But how can we begin from scratch? If technical-rational ways fail to help find hope and possibilities for curriculum change, how else can curriculum change be understood? Is it possible to break free from the entrapment of technical ways of thinking? At a time when the need for change in science education is critical, where does hope for change exist?

It was these questions that occupied my thinking during the summer of 1989. As the controversy in Alberta over the proposed science programs swelled I spent a few days camping with my family. Once again destiny intervened in my life, this time in the persons of the two young men from Quebec camping next to us. As we visited, I shared my interest in curriculum change, experiences in Alberta, and the questions I was pondering. "Have you read Foucault?" they asked. I admitted I knew only of the French physicist, Jean Foucault; was this who they meant? They laughed, and told me to pick up some of the works by Michel Foucault, the French philosopher. I told them I would, later during the summer I found a collection of Foucault's essays (the philosopher, not the physicist), The Foucault Reader (Rabinow, 1984a). I found the words by this man quoted on page six of the The Foucault Reader riveting. "It seems to me, " expounds Foucault, "that

> the real political task in a society such as ours is to criticize the working of institutions which appear to be both neutral and independent; to criticize them in such a manner that the political violence which has always exercised itself obscurely through them will be unmasked, so that one can fight them. (Foucault, quoted in Rabinow, 1984b, p. 6)

As I returned in the fall of 1989 to my studies at the University of Alberta, employment with Alberta Education, and work as an author of the introductory chapter to Visions 1 I found these words by Foucault kept returning to me. The controversy over the new science programs and subsequent failure of significant change seemed like an act of violence on everyone involved. But how can we fight such acts? I began to expand my reading of this philosopher, discovering to my delight inspiration and instruction. By November that year I began to have a sense that somehow the ideas of Foucault "will be essential" (Journal entry, November 1, 1989) in the task of addressing questions about the possibilities of curriculum change. My main interest, however, was an essay on technology by the German philosopher Heidegger. One passage in particular offered a profound insight (Heidegger (1954/1977):

> The essence of technology lies in enframing (*Das Ge-stell*). Its holding sway belongs within destining. Since destining at any given time starts man [sic] on a way of revealing, man [sic], thus underway, is continually approaching the brink of the possibility of pursuing and pushing forward nothing but is revealed in ordering, and of deriving all his [sic] standards on this basis. Through this the other possibility is blocked. (p. 307)

In this passage Heidegger suggests technological orientations are not just the destiny of the modern era, but are active, a 'destining' that reveals nothing since all standards are based on technological thinking. Chapter 5 of this dissertation will discuss more fully the significance of Heidegger's insights to curriculum change, the major point of Heidegger's essay is that technological approaches and thinking enframe (Ge-stell) our destiny and thus limit possibilities. Commenting on Heidegger's notion of Ge-stell, Levin (1988) suggests we are born "with eyes opened by enchantment" (p. 58), but 'growing up' is actually a process of "progressive closure of the dimensionality of Being" (p. 59) which is our modern, technological destiny. Levin argues the result of this destiny is a restriction of vision: in modern expressions of the Great Conversation we live, claims Levin, with a "certain 'normal' blindness" (p. 60) to possibilities. If Heidegger's view of modern technological thinking is correct, then technical-rational approaches to curriculum change are hopelessly enframed, limiting possibilities for change. Seen this way, curriculum change involves somehow breaking free from the enframing nature of well established, technological approaches to curriculum change; metaphorically like finding a "5th corner" of a new frame of seeing (Blades, 1990). But how do we find this opening of vision, this new way to think about and look at change in ways not thought or seen before? My reading during 1990 led the way: To address this fundamental question about curriculum change, we need to include the words of the French philosopher Michel Foucault in our conversation.

CHAPTER 3
RESEARCHING POWER IN A SCIENCE EDUCATION CURRICULUM-DISCOURSE

Introduction: Beyond Modernity in Curriculum-Discourse

When I was a high school teacher I sponsored an annual overnight camping trip to the Mt. Arrowsmith mountain range on Vancouver Island. Standing on the peak of a mountain is a singular experience: one feels a sense of exhilaration and oneness with the world spread before you. During one particular trip we decided to hike down to a small lake nestled in the mountain range. We reached the lake easily enough, but during the climb back mists rolled in and somehow I became separated from the main group. Still, after many trips I had come to feel so familiar with the surroundings and landmarks that I felt confident I could find my way out, even in the mist. I continued to climb. After awhile the mist cleared, and I found myself on a small ledge completely opposite from where I should be. Even worse, below was a sheer drop of perhaps 500 meters directly into the lake. Terror entered my soul as I realized there was no way out! I clung to the wall, wondering what to do.

My situation is a metaphor of our modern age. Modern expressions of the Great Conversation centre on a belief in the "steady progress of reason and freedom" (Fraser & Nicholson, 1990, p. 22) through "prediction and control" (Borgmann, 1990, p. 2). But the promise of modernity to "liberate humankind from ignorance and irrationality" (Rosenau, 1992, p. 5) has become increasingly suspect in the light of world events this century. Rosenau notes that "world wars, the rise of Nazism, concentration camps (in both East and West), genocide, world-wide depression, Hiroshima, Vietnam, Cambodia, the Persian Gulf, and a widening gap between the rich and the poor makes any belief in the idea of progress or faith in the future questionable" (p. 5). As the twentieth century comes to a close we "no longer have the confidence to invest belief in the foundational myths of inevitable human rationality or social progress" (Mercer, 1990, p. 49). The Great Conversation hesitates with a hopelessness and despair that echos, as the popular song goes, in the "sounds of silence" (Simon, 1964). Humankind has climbed onto a ledge, and as the mists clear we know we are trouble but there seems to be no clear direction which way to go.

Education has, since the late sixties, continued to climb the metaphorical mountain confident in the familiarity of technical-rational approaches to curriculum change. Despite the growing mists of doubt about the actual success of the technical-rational model, educational discourse has clung to the promises of modernity, investing hope that eventually a solution to curriculum change would appear. Part of the Great Conversation, educational discourse is also located on a ledge high above a great fall. In this precarious position, many in education discourse continue to grasp prediction and control as if "it were the sole alternative to sullen silence" (Borgmann, 1990, p. 2). But Heidegger (1954/1977) reminds us prediction and control are rooted in technological thinking which through destining has placed humankind in danger.

Flat against the mountain, high up on a ledge I had a real sense of the word danger! I began to yell for help. After a few moments a student heard me and began to give me directions out of my predicament. I had to trust her advice since I could not see where I was going. But she could see the way clearly, and her voice was able to guide me to safety.

So it is in our modern condition. In the last half of this century philosophers have sought a way out of the destining of modernity (Milner, Thomson & Worth, 1990, p. ix). Their project has been to move beyond the modern, to find a post-modern way from the danger of technological destining. Their example responds to our call for help in curriculum change, a direction that guides education discourse off the precipice of modernism. A post-modern project in curriculum change, however, is disquieting and unfamiliar: we are asked to abandon the idea of a rational and autonomous human subject, belief in the ability of any meta-discourse to represent the truth of first-order discourses and any notion that a single right practice exists (Lyotard, 1979/1984; Madison, 1988, Vattimo, 1985/1988). Clearly, the post-modern project will not enable us to propose a general theory of curriculum change! Instead, the move towards post-modernism begins with an "archeology of modernity" (Huyssen, 1990, p. 260) that in a curriculum-discourse requires the deconstruction of the very Ge-stell that presently binds possibilities for change. This deconstruction effectively turns a curriculum-discourse on itself by questioning what the curriculum-discourse does to limit possibilities for change and, in the process, hopefully opening our conversation to new possibilities. This is a difficult task, but we are not alone. There are voices calling across the mountain to help us: One of these voices comes from the French philosopher Michel Foucault.

Foucault's Invitation to Re-Search Power

In all events a *will to power* is operating.
Nietzsche (1887/1967), On the Genealogy of Morals, p. 78 (Emphasis his).

Foucault and Possibilities for Curriculum Change

During the summer of 1989, right at the height of controversy in Alberta over the proposed changes to senior high school science education, I was teaching an undergraduate summer course in science education at the University of Victoria. As you recall from Chapter 2, while camping with my family before reaching Victoria I met two students who recommended I read the works of Michel Foucault (1926-1984).[1] Teaching at the University of Victoria allowed me some time for summer reading so I decided to take the advice of the two students and purchased the Foucault Reader, (Foucault, 1984a), a selection of Foucault's essays and excerpts from some of his books. I immediately was captured by this work. Paul Rabinow comments in the introduction to this reader that Foucault believes we are engaged in political struggles all the time (Rabinow, 1984a, p. 6). The point of these struggles, claims Foucault, is "to alter power relations" (Foucault, quoted in Rabinow, p. 5). That made complete sense to me. The power Alberta Education held in the science education curriculum-discourse seemed to me to be usurped by the power of the University of Alberta Faculty of Science. If this power could be altered or controlled, then perhaps curriculum change would have proceeded more smoothly.

I soon discovered, however, that Foucault means something quite different than my structuralistic view of power. In his essay Truth and Power appearing in the Foucault Reader, Foucault (1984b) describes power as something "exercised--concretely and in detail--with its specificity, its techniques and tactics" (p. 57) in what he calls relations. Later in this essay Foucault cites an example of what he means by power: In European feudal societies, power functioned through "signs of loyalty to feudal lords, rituals, ceremonies, and so forth, and levies in the form of taxes, pillage, hunting, war, etc." (p. 66). Foucault then claims that in the seventeenth and eighteenth centuries institutions devoted to the study of population demographics, public health, and safety were born. Foucault claims the rise of interest in the most minute detail about individuals, expressed in concerns about the housing, fertility and longevity of the masses, re-presents a new form of power that "begins to exercise itself through social production and social service. It becomes a matter of obtaining productive service from individuals in their concrete lives" (p. 66). Instead of power functioning to modify outward behaviour, as it once did in feudal times, during the seventeenth and eighteenth centuries power literally became incorporated in the sense that "power had to be able to gain access to the bodies of individuals, to their acts, attitudes, and modes of everyday behaviour" (p. 66-67). Foucault continues, "hence the significance of methods like school discipline, which succeeded in making children's bodies the object of highly complex systems of manipulation and conditioning" (p. 67). And, Foucault maintains, it is these "implicit systems in which we find ourselves prisoners" in our modern era (Foucault, 1971/1989, p. 71). I found Foucault's essay on power very upsetting. Was Foucault suggesting that in my role as high school teacher I had been part of a complex nexus of manipulation and conditioning that is the functional expression of power in a system? Was power something that defines how I thought and acted in my everyday life? I was to spend a good part of my summer contemplating the implications of this thought.

---

[1] For a brief biography of Michael Foucault please turn to Appendix B.

Sometimes in a life a junction of events serves to completely turn around thinking. When I returned in the fall to my studies at the University of Alberta and my position with Alberta Education, I found out the new programs were in jeopardy and the textbook chapter I had written for Science 10 rejected for being too STS in orientation. One of my university courses that fall explored what was for me the timely topic of curriculum change. Each member of our class was asked to give a presentation of possibilities for change in their subject interest area. Frankly, given the history of Science 10-20-30 I had become sceptical *any* possibility for real change in science education existed. As I set out to plan my presentation, it occurred to me that in all my thinking about curriculum change, I had never really defined change itself. What *is* change? While pondering this question someone very close to me shared how they had converted from one religion to another. Certainly their conversion was accompanied with a change in life; I decided exploring the conversion act might reveal insights on change. I found the word "conversion" literally means to completely turn around, to face a totally new direction, revealing a new horizon of possibilities. But how could this turning happen in curriculum-discourse? Heidegger's words returned to me: "the essence of technology lies in enframing. Its holding sway belongs within destining" (Heidegger, 1977/1950, p. 307). Heidegger continues to suggest this enframing (Ge-stell) blocks any other possibility. Heidegger's observation suggests any curriculum-discourse enframed by technical thinking will experience a destining that blocks possibility for change. If this is true, then change in a curriculum-discourse would involve some way of breaking free from this destining, to completely turn around and find a new direction. Clearly change involves more than tinkering with an existing system, change is much, much more difficult: it is an effort to break from the systems in which we are trapped.

Exactly at the time this occurred to me I was continuing my study of Foucault's concept of power, widening the scope of my reading to include interviews with Foucault and commentaries on Foucault's works and ideas. To the question, "How do you uncover today's discourse?" (Foucault, 1971/1989a, p. 63) Foucault replied that he tries to show "those systems which are still ours today and within which we are trapped. It is a question, basically, of presenting a critique of our time" (p. 64). These systems are able to exist within the social body through a multiplicity of force relations which Foucault calls *power*. A crack in the frame of technicality appeared in my thinking: I began to believe discovering the procedures of power in a curriculum-discourse might expose possibilities for escaping the system of technicism that has driven curriculum-discourse for decades. I was able to complete my presentation for my class on change, which I entitled, Possibilities for Change in Science Education. A journal entry captures how I felt when I realized change is possible: "I'm excited! I believe I'm on to something with Foucault. A research proposal is forming, but there is much to do. I must read Foucault carefully" (Journal entry, October 30, 1989). I also note in that entry that increasingly I was finding my work at Alberta Education "a hindrance" to my studies. On December 13, 1989 I resigned from Alberta Education. Ironically, the last validation I was working on was a review of the doomed 1989 Science 10-20-30 program of studies. This report, like the original programs themselves, was destined to be never finished.

What is the Purpose of Engaging in Educational Research?

Research literally means 'to search again.' Doing research, then, implies that a search has already taken place and that another search is needed. What is research in education? With the texts of the science education curriculum-discourse in Alberta, I originally searched for an understanding of the genesis and evolution of Science 10, 20 & 30. This search exposed the fruitless quest of technical-rational approaches to curriculum change, leading to the prediction that structuralism in modern interpretations of the technical-rational model of curriculum change will also prove barren. As is often the case in a search to understand, new questions emerge. The questions I faced were simply, "Now what? Is curriculum change possible?" It was my reading of Foucault that encouraged me to believe this question might be addressed. As the Minister of Education announced in early 1990 a complete rewriting of the high school science programs, I was at the University of Alberta, pondering *how* to re-search power in the science education curriculum-discourse of Alberta.

Before I could proceed, I had to address the same question everyone contemplating educational research, or any research for that matter, must face: "Why bother? What is the purpose of this research act?" I could not hope to develop a new model of curriculum change; the moment research becomes analysis that leads to prescription one succumbs to the modernistic destining of technical-rational structuralism! How could my re-search present "meaningful descriptions and interpretations of events and phenomenon" (Jacknicke and Rowell, 1987, p. 66) in the evolution of Science 10, 20 & 30 without falling into the "structural and discursive determinism" (Cherryholmes, 1985, p. 62) of technicality? If my interpretation of the procedures of power in a curriculum-discourse does not point to any particular model of curriculum change, then what is the point of researching the evolution of Science 10-20-30?

In my case, I believe the value of my research lies in how this act *can initiate a conversation of critique*. I remember one sunny afternoon during my first year teaching I happened to have a rare free period, so I decided to sit on the front steps of our school. After only a few minutes, the principal of our school joined me. Sitting together, this principal charged me to always remember that I am a teacher first, a subject specialist second. "You don't teach science," the principal continued, "you teach children." I was startled; I had never thought of teaching in these terms, defining myself as a biology teacher until that afternoon. I began to wonder what it means to teach children, beginning an "interpretive inquiry" (Jacknicke and Rowell, 1987; Soltis, 1984) of critique that was to affect my whole orientation to teaching, even to the present. Through constant critique on my life as teacher, my thinking about teaching changed from a subject focus to a focus on the child. Foucault defines critique as "seeing what kinds of self-evidences, liberties, acquired and non-reflective modes of thought, the practices we accept rest on" (Foucault, 1982, p. 33); a dis-covering of the way we think and act. As I found out that afternoon conversing with the principal of our school, "the moment one begins to be unable, any longer, to think things as one usually thinks them, transformation becomes simultaneously very urgent, very difficult, and altogether possible" (p. 34). Therein lies hope and possibility: *Our hope is that critique of the enframing nature of technical thinking in a science education curriculum-discourse itself is transformational, revealing possibilities for change in the curriculum-discourse.* From this perspective, re-search is not a smooth process leading to a product that can be presented, but an on-going invitation to critique, an opportunity to crack open the destining of technicality. Since I am part of the science education curriculum-discourse in Alberta, my re-search of procedures of power in the evolution of Science 10-20-30 is a reflexive act, an introduction into the curriculum-discourse a conversation of critique on how this discourse prevents change, with the hope that conversations of critique might initiate possibilities for change.

This research in education is a messy, personal business. Clear steps will not be obvious and no product forthcoming. I can not tell someone how to begin or proceed, neither do I recommend anyone follow in my footsteps, even if I could retrace them with perfect clarity. What I can do, however, is share with you my re-search journey and, in the next chapter, the procedures of power I dis-covered. It is precisely in this sharing that research becomes even more personal. In the Introduction of this dissertation I have described the reading of the text before you as a conversation. It is so in that my sharing enters your thoughts and, should you return to this text once again in thought or reading, a true conversation emerges in the new meanings, ideas, and departures you find. Now, I suggested in the introduction to Chapter 2 the text of this dissertation is also part of the science-education curriculum discourse in Alberta. If your reading is conversational, you have also become part of this curriculum-discourse; we are in this together! Building a conversation of critique in the science education curriculum-discourse now becomes a joint task between you and I. The text that follows, then, extends an invitation for you to take an active part in curriculum change by joining me in a research project that begins a conversation of critique.

Foucault's Rethinking of Power

Our conversation continues with a question:

> What possibilities for curriculum change are revealed by re-searching the procedures of power in the evolution of Science 10-20-30 in Alberta?

Let us continue our conversation preserving an openness to this question by avoiding forming opinions or conclusions too rapidly (Carson, 1986). Instead, several new questions emerge from the question I have just posed:

> What are 'procedures of power?'
> Is it possible to re-search these procedures of power?
> If so, how might this research proceed?

These three questions were only vaguely expressed in my thinking when I met in January, 1990 with one of my Alberta Education colleagues for advice in my researching the evolution of Science 10-20-30. It was a wonderful, rich meeting. This colleague was able to confirm my account of the major events in the genesis and evolution of Science 10, 20 & 30 and suggested some further documents I should review plus a list of the people I would want to speak to in my research. I record in my journal entry that evening this colleague was, "very willing to answer any questions or even tell me what I should ask different individuals" (Journal Entry, January 19, 1990). I came away from this meeting confident that "now my research details can be worked out" (same entry).

During our meeting my colleague strongly recommended I continue to gather texts from the science education curriculum-discourse since the evolution of Science 10-20-30 was anything but over. I agreed, and over the next year I was a regular visitor back at Alberta Education, collecting newspaper clippings, reading reports and surveys, interviewing those involved in the evolution of Science 10-20-30 and generally gathering every trace of the evolution of Science 10-20-30 I could find.

At the same time, I entered into a conversation with Foucault's writings on the word power. Being back on campus allowed me to spend more time discussing my studies with fellow graduate students. On a coffee break one day my friend Keith asked me what Foucault means by power. I admitted it was easier to say what Foucault doesn't mean. When he speaks of power Foucault does not refer to "a group of institutions and mechanisms that ensure the subservience of the citizens of a given state" (Foucault, 1978/1990, p. 92). To Foucault, power does not mean a "general system of dominance exerted by one group over another" (p. 92). Correspondingly, Foucault does not adopt a Marxist view that power exists as a type of capital that can be held, exchanged, traded, or lost. Dreyfus & Rabinow (1982) observe that Foucault never considers power a "commodity, a position, a prize or a plot" (p. 185). Power is not even necessarily a repressive force; indeed, claims Foucault, power "doesn't always weigh on us as a force that says no, but that it traverses and produces things, it induces pleasure, forms knowledge, produces discourse" (Foucault, 1977/1980, p. 119). In fact, according to Foucault power does not exist at all in the substantive sense (Ryan, 1991).

Let us return to my Keith's question. What does Foucault mean by power? Foucault provides a post-modern response by avoiding any suggestion of a theory of power in his many works and interviews. Foucault consistently avoids the question, "What does power mean?" by addressing a different question, "What does power do?" Deleuze (1986/1988) describes Foucault's view of power as Nietzschean; indeed Foucault's project was very influenced by Nietzche's The Genealogy of Morals (1887) (Dreyfus & Rabinow, 1982; Eribon, 1989; Foucault, 1973/1989b). In this work Nietzsche calls us to question traditional interpretations of history advancing instead that behind all events "a will to power is operating" (Nietzsche, 1887/1967, p. 79). Nietzsche elaborates with an example: "one also imagined that punishment was devised for punishing. But purposes and utilities are only *signs* that a will to power has become master of something less powerful and imposed upon it the character of a function" (p. 77, emphasis his). Foucault (1975/1979) explores this hypothesis in his book, Discipline and Punish (1975). In this work Foucault discovers "the system of thought, the form of rationality, which since the end of the 18th century has underlain the idea that the prison is in sum the best means, one of the most efficient and rational, to punish factions in a society" (Foucault, 1983/1989c, p. 280). This system of thought, one of the many which define our modern era, is "established, consolidated, and implemented through the production, accumulation, circulations and functioning of a discourse" (Foucault, 1977/1980, p. 93). This discourse exists and functions through relations Foucault calls power. After nearly two hundred pages describing in often gruesome detail the genealogy of discipline and punishment techniques Foucault (1975/1979) urges us in Discipline and Punish to

> cease once and for all to describe the effects of power in negative terms: it 'excludes', it 'represses', it 'censors', it 'abstracts', it 'masks', it 'conceals'. In fact, power produces; it produces reality; it produces domains of objects and rituals of truth. The individual and the knowledge gained of him belong to this production. (p. 194)

Individuals, claims Foucault, are the "vehicles of power, not its point of application" (Foucault, 1977/1980, p. 98). Thus, the individual is not vis-à-vis power, they are prime effects of power. Dreyfus and Rabinow (1982) explain:

> Power is a general matrix of force relations at a given time, in a given society. In the prison, both the guardians and the prisoners are located within the same specific operations of discipline and surveillance, within the concrete restrictions of the prison's architecture. (p. 186)

In other words, neither the prisoners nor their guardians possess power, rather each group acts and thinks in ways defined by the system of force relations within which they are trapped. It is this active, continuous, forceful, anonymous entrapment and definition of being that is power. And parallels of these force relations exist within systems everywhere: in hospitals, military, religious organizations and, of course, schools, universities, and government Ministries of Education.

Foucault's view of power is comforting and discomforting at once. I am comforted to realize that the power of the status quo in science education curriculum-discourse is not held by a location or person. Applying this concept to the events surrounding the evolution of Science 10-20-30 program blame becomes pointless in the failure of change; there was no conscious conspiracy toward maintaining the status quo, no group or individual *had* power over the events that led to the demise of the original program and subsequent devolution of the new program towards an amalgam of what existed before. *The events themselves were expressions of power*. But from this realization springs the discomforting thought that we are all trapped in a curriculum-discourse, destined to fail at change before we start by the technicality of our system of thought and action. It is precisely the formation and functioning of this destining and how we might fight against it, that is, how change is possible in the established order of things, that is Foucault's project.

The Influence of Foucault's Project

Given Foucault's unusual and provocative perspective on power it is not surprising Foucault's project has entered sociological discourse, although it seems the writings of Foucault defy easy categorisation. Rajchman (1985) and Gane (1986) observe that Foucault's work has been described in sociological literature as structuralist, post-structuralist, irrationalist, relativist, anarchist, nihilist, neo-eclectic, phenomenological, empiricist, and even neo-positivist! Foucault deplored attempts to categorize his work, beginning one of his books with the request that readers "do not ask who I am and do not ask me to remain the same" (Foucault, 1969/1972, p. 17). When asked to describe his work, Foucault was characteristically vague:

> My own work? As you know, it's very limited. Very schematically, it consists of trying to discover in the history of science and of human knowledge (*des connaissance et du savoir humain*) something that would be like its unconscious. (Foucault, 1968/1989d, p. 39)

Dreyfus & Rabinow (1982) argue classifying Foucault's work will remain elusive since Foucault presents a "sustained and largely successful effort to develop a new method" (p. xii) of research in the human sciences.[1] This new method has been adapted widely to the studies in such diverse areas as social origins of pornography (Paden, 1984), implications of feminism to change in social order (Fine, 1988; Miller, 1987; Walsh, 1986), the sociology of work (Wirth, 1989); the discourse of development in the Third World (DuBois, 1991), English literary criticism (Blair, 1987), studies of culture (Kurzweil, 1983) and even studies of the peace movement (Broughton and Zahaykevich, 1982). Even a cursory glance through the *Social Sciences Citation Index*[2] confirms Roth's (1992) assessment that Foucault's works have been and continue to be cited and contested extensively in the humanities and social sciences.

---

[1] And, from a post-modern perspective, should remain elusive. The role of the author in post-modern writing is discussed in the next chapter.

[2] A reference work that lists, by author, citations of these authors among major sociological journals. There are *hundreds* of citations of Foucault's work recorded in the *Citation Index*.

Foucault in Education Discourse

References to Foucault in educational research are becoming increasingly popular. Spellmeyer (1989) suggests Foucault's insights can help English teachers show their students how discourse affects, and is affected by, "games of truth" (p. 716). Da Silva's (1988) study of inner city schools in a Brazilian city draws on Foucault's study of the relationship of power and knowledge. Bowers (1980) suggests educational discursive practice is dominated by the tendency to "think theoretically, to segment experience, [and] to emphasize the measurable" (p. 303); what I describe in Chapter 2 as a technical-rational approach in education discourse. Bowers argues change in education discursive practice begins with a Foucauldian critique of how present discourses are mediated by power.

Luke, Castell, & Luke (1983) suggest Foucault's notion of power brings a critical awareness to questions about the role and authority of textbooks in schools. Cherryholmes (1988a) agrees. He brought Foucault's insights to an examination of the discourse presented in a social studies textbook. Cherryholmes advances the Foucauldian notion that textbooks are a type of discourse which results from "severe forms of restraint" (p. 8) such as provincial guidelines, avoidance of controversy, and the expectation and desires of the teachers. This restraint, argues Cherryholmes, is part of an educational discursive practice which shapes the discourse of a textbook through the visible and hidden effects of power; in the next chapter we shall see an example of this dynamic.

Even though discussions of the the potential of Foucault's insights to educational research are very limited (Roth, 1992), Marshall (1989) feels that Foucault "has much to offer education" (p. 101). With his tongue firmly in his cheek, Marshall feels that even if Foucault's work proves to be wrong, it is "right enough to be disturbing" (p. 101). In an introduction to a collection of essays which reflect Foucault in their education research orientation,[1] Ball (1990) suggests a Foucauldian analysis of discursive practice in education presents real hope in unmasking "the politics that underlie some of the apparent neutrality of educational reform" (p. 7). Cherryholmes (1987) supports this position, arguing that the insights of Foucault apply to understanding curriculum change. Cherryholmes observes that the search in educational discourse to find a fixed theory which can, once and for all, "tell us what curriculum is and authoritatively tell us what to do when it comes to developing, implementing, and evaluating curriculum" (p. 309) is misplaced. Foucault teaches us, suggests Cherryholmes, that our discourse about education should turn from "talking primarily about taxonomies of objects, systems of disciplines, and learning objectives" (p. 310) towards a discourse about "the kind of society and schools we want knowing full well that they constitute each other" (p. 310).

---

[1] Ball, S. (1990). Foucault and education: disciplines and knowledge. S J. Ball (Ed.). N.Y.: Routledge.

A few recent studies of curriculum change have drawn on Foucault's conceptualization of power. Walker (1986) situated strong support for the teaching of English grammar in Nova Scotia schools during the 19th century by using a Foucauldian and Kuhnian analysis of the dominant discursive practices in Nova Scotia during that era. Evans (1987) examined how power was involved in a principal's role in curriculum change. Friedman and Popkewitz (1988) used Foucault's notion that a curriculum change discourse is related to power in their examination of the development of art education from 1860 to 1920. In his investigation of curriculum reform in Canada, Curtis (1988) noticed a tendency of reforms, especially initiatives generated by local schools, to be increasingly controlled and frustrated by a centralization of administration of the reforms. The inevitable surveillance and control of the reform by a centralized agency functioned to limit the involvement of teachers and students in the reform. Drawing on the insights of Foucault's work, Curtis claims this functioning is the effect of power in attempts at curriculum reform. As we shall see in Chapter 4, through the procedures of marginalization and consultation this same type of delimitation by a centralized agency affected the possibility of change in the science education curriculum-discourse in Alberta.

Foucault's insights helped Bjerg & Silberbrandt (1980) understand the increasing bureaucratization and final demise of an attempt at curriculum reform at a Danish university. Not only were the effects of power in enframing and limiting possibilities evident in this attempt at curriculum change, but Foucault's concept of how truth interacts with power was also clear. The development of a public truth that the reform project was out of control eventually led to the steady invasion of administrative restrictions which re-introduced the limits of dominating curriculum meta-discourses. The result was the predictable demise of the reform. In similar fashion, the production of public truths also had a key role in determining the direction of science education reform in Alberta. The effects of this production of truth will be presented in the next chapter.

Commenting on the event in Denmark, Bjerg & Siberbrandt came to the conclusion that "social change is not brought about as the result of transformation of academic institutions. The problem is part of a total social context of power structures" (p. 260). Drawing from the work of Foucault, they situate hope for curriculum change in a openness to possibilities which comes from a greater understanding of role of power in discursive practice.

To date, only a few studies in education have directly investigated the insights of Foucault to finding hope for curriculum change and no studies have sought to reveal the procedures of power in a science education curriculum-discourse. I have advanced in the previous chapter that education discourse in Alberta is enframed by technicality, offering little hope to those voices calling for change in science education. To this dilemma Foucault presents an agenda of hope through his invitation by example to re-search procedures of power in a curriculum-discourse. Our conversation continues by exploring *how* these procedures of power might be discovered.

The Archaeology of Procedures of Power in a Curriculum-Discourse

How shall you rise beyond your days and nights unless you break the chains
which you at the dawn of your understanding have fastened around
your noon hour? Gibran (1977), The Prophet, pp. 42-43.

Collecting Documents

During the spring of 1990 I continued to gather texts from the evolution of Science 10-20-30 while at the same time continuing my effort to make sense of Foucault's concept of power. I actually was engaged in two processes at once: every text I collected extended my original search to understand the evolution of Science 10-20-30 while, at the same time, I re-searched these texts to discover how power operated in the science education curriculum-discourse. This was not a tidy process! Minutes of a meeting, an article in a newspaper, or some other document that came my way would typically stimulate new questions in my re-search, requiring further documents. Document widely refers to textual material such as newspaper articles, Alberta Education publications, drafts of textbook chapters, news bulletins by professional organizations, and magazines and journals which were part of the Science 10-20-30 curriculum-discourse. Every document I collected was studied, then grouped into one of five categories:

1. Documents generated from communications with Gage Publishing and Alberta Education.
2. Articles and other publications (e.g., cartoons) in the newspapers of Alberta and the *Alberta Report.*
3. Publications from professional interest groups such as the Alberta Medical Association, Association of Professional Engineers, Geologists and Geophysicists in Alberta, and universities in Alberta.
4. Documents from the Alberta Teachers' Association and affiliated member groups, such as the Edmonton Regional Science Council.
5. Publications from Alberta Education related to the science education curriculum-discourse, including all drafts of the Science 10-20-30 Programs of Study.

These documents were then used to prepare the events matrix chart described in Chapter 2 (pp. 60-61). Developing this chart was a dynamic process that continued as long as documents were collected. I was continually moving items from one category to another (and sometimes within categories), adjusting the chronology of events and noting significant movements in the curriculum-discourse while at the same time trying to understand what effects of power were revealed by the chart.

By March, 1990 I found the events matrix chart developing well, but my research faltering. I note rather sadly in my journal: "My thesis research seems to be getting nowhere. The job seems so massive" (Journal entry, March 8, 1990). Mere hints, if that, of nature of power in the curriculum-discourse seemed to emerge from the developing events matrix chart. What did emerge in quantity from my original search to understand the evolution of Science 10-20-30 were questions! For example, how did the phrase "watered down science" first enter the curriculum-discourse? I had reports of consultation with teachers by Alberta Education personnel, but what did this consultative process do? Several accusations and insinuations pervaded the science education curriculum-discourse. How did these affect the lives of those involved in the discourse, in turn affecting the discourse itself? To say I was overwhelmed would understate my feelings that spring.

In early June, 1990 I realized my research of the evolution of Science 10-20-30 would need to delve deeper into the impressions, memories and experiences of events of which documents constitute a mere shadow. I would need to interview people involved in the discourse. I applied to the Alberta government Minister of Education for permission to interview individuals working at Alberta Education, receiving this permission July 25, 1990.[1]

Archaeology as a Trachealizing Act

A poorly defined but nagging concern about interviewing remained with me while I spent another summer teaching at the University of Victoria. In early fall, 1990 I travelled to a curriculum conference in Dayton, Ohio to present a paper on the implications of Heidegger's concept of Ge-stell to issues about curriculum change. I sat with Terry Carson, a professor in my department at the University of Alberta on the trip to Dayton. I shared with Terry my frustration in my research experience and vague concern about interviewing. His advice came in the form of a simple, direct question: How did Foucault go about researching?

After several months of exploring Foucault's idea of power I assumed an understanding of how power operates in a curriculum-discourse, what I was beginning to call the procedures of power, would become self-evident as I gathered documents. Terry's question cut right to the heart of my difficulty; when I returned from Ohio I immediately began to study Foucault's strategy for discovering power in a discourse.

Foucault describes his strategy for discourse analysis as the "archaeology of knowledge" (Foucault, 1969/1972, 1969/1989e; Paden, 1986). After my experience the previous spring, I readily agreed with Foucault that discovering procedures of power in a discourse is indeed an archaeological task. Characteristically, Foucault means more than exhaustive research and painstaking reconstruction of texts when he refers to his re-search as archaeological.

First, Foucault admits he is not searching for the foundations of knowledge in a discourse, nor relations in a discourse that are "secret, hidden, more silent or deeper than the consciousness of men" (Foucault, 1969/1989e, p. 46). Foucault is not interested in a hermeneutic analysis of discourse.[2] To understand discourse-practice Foucault inverts the traditional approach of hermeneutics to understanding meaning-giving through an analysis of discourse-products (e.g., texts, symbols, spoken word). Foucault suggests this search for meaning in the products of a discourse could go on forever and thus will always remain elusive; instead, argues Foucault, we should examine how discourse is *used*, by revealing the *practice* of discourse in the social order:

---

[1] A copy of this letter can be found in Appendix C of this dissertation.

[2] Hermeneutics is the philosophy of interpretation. A major goal in hermeneutic analysis is discovery of meaning.

> I'm not looking underneath discourse for the thought of men [sic], but try to grasp discourse in its manifest existence, *as a practice* that obeys certain rules--of formation, existence, co-existence--and systems of functioning. It is this practice, in its consistency and almost in its materiality, that I describe. (p. 46, emphasis mine)

Foucault's archaeological re-search does "not treat discourse as *document*, as a sign of something else," (Foucault, 1972/1969, p. 138, emphasis his) but instead is concerned with discourse "as a *monument* " (p. 139, emphasis his) in social practice. Foucault deftly side-steps the hermeneutic question, What does discourse *mean*? by asking, What does discourse *do*?, followed closely by the political question, How else could it *be*?

Second, Foucault refuses to separate knowledge from power. Foucault agrees with social-critical theorists[1] such as Habermas (1968/1982) that knowledge is always tied to human interests but Foucault finds departure from social-critical theory by arguing there is no distinction between knowledge, human interests and power. For example, Foucault demonstrates that the rise of interest by the Bourgeoisie in the incarceration and rehabilitation of prisoners in 18th and 19th century France was not primarily an interest in the phenomenon of delinquency, but a discourse of power based on the production of truth, justified as the acquisition of knowledge. After all, points out Foucault (1977/1980):

> the bourgeoisie could not care less about delinquent, about punishment and rehabilitation, which have little economic importance, but it is concerned about the complex of mechanisms with which delinquency is controlled, pursued, punished, reformed, etc. (p. 102)

---

[1] Social-critical theory develops from attempts to reconceptualize Marx's ideas on social progress. Some of the characteristics of social-critical theory in the social sciences are: Critical view of rationalism, rejection of positivism in social sciences, belief in theory development through dialectic criticism, and redefinition of culture as essentially political, dynamically open to domination by the ideology of capitalism (Giroux, 1983). Habermas, Adorno, Marcuse and other social-critical theorists founded the Institute for Social Research in Frankfurt, Germany in 1923. This so called "Frankfurt School" was destined to have an influential role in the development of social-critical theories.

In other words, what the discourse on delinquency in the 18th and 19th century, and the accompanying medical discourse on madness, *did* allow was more access and surveillance of the common people by the Bourgeoisie. This access was legitimized as knowledge needed to search for, study, and rehabilitate the madman and delinquent. Foucault suggests we adopt an attitude of suspicion towards the discourse on madness and delinquency in 19th century France; the search during that time to cure madness and solve delinquency may be less altruistic than it seems.

Third, Foucault's archaeology of power/knowledge is a type of deconstruction that trachealizes discourse.[1] Buck and Osborne (1990) define deconstruction as "a novel way of questioning prevalent philosophies, ideas, assumptions, and constructs regarding current social, political, and economic practices" (p. 178). Madison (1990) describes deconstruction as "essentially a critique" in post-modernism (p. 110), represented in the works of Foucault and the contemporary French philosopher Derrida, which involves an "attack on the very notion of the subject and of lived experience as the ultimate source of meaning" (p. 92).[2] While Foucault and Derrida have a "similarity of critical focus" (p. 95) they operate from very different strategies and agendas. To Derrida, deconstruction is le jeu (the game), an approach which recognizes there are "only differences" (Derrida, 1972/1982, p. 11) in discourse, since "every concept is inscribed in a chain or in a system which it refers to the other, to other concepts, by means of a systematic play of differences" (p. 11). This deconstruction as a play of differences cannot speak from a position, and thus, according to Madison (1990), it speaks from nowhere, "leads us nowhere, and this is precisely why it is nihilistic" (p. 110).

Foucault adopts a different approach. The purpose of his deconstruction is to reveal possibilities of freedom from the systems in which we are entrapped while avoiding any presumption of a meta-discourse. From this post-modern stance, deconstruction is "more of an approach to understanding human discourse and behaviour than a particular method of analysis" (Buck & Osborne,

---

[1] τραχηλιζω = Trachelizo, from the passage: παντα δε γυμνα και τετραχηλισμενα τοις οφθαλμοις αυτου προς ον ημιν ο λογος, "but all things are *naked and laid bare* to the eyes of him with who is our account" (Hebrews 4:13b, Zondervan (1978), New International Version Bible, p. 1578, emphasis mine). The term was commonly used in Greek wrestling. During a match exposing the trachea of an opponent, "trachealizing" the person wrestled, led to an automatic victory for the wrestler.

[2] Derrida founded deconstructionism in France and was one of Foucault's students. For a discussion of their conflict and eventual resolution, see Eribon (1991), p. 116-122.

1990, p. 179). Foucault's approach in his deconstructive archaeology of knowledge is to *trachealize* a discourse: metaphorically Foucault wrestles with the discourse with the intention of exposing the weakness of the discourse for all to see. This deliberate, aggressive research act attempts to show that "things are not as obvious as we might believe, doing it in such a way that what we accept without saying no longer goes without saying" (Foucault, 1982, p. 34). And so we come to the heart of Foucault's project: As the procedures of power/knowledge in a discourse are dis-covered it is no longer possible to think as one thought and freedom becomes possible (Gillan, 1987). The current Dalai Lama of Tibet (Tenzin Gyatso, 1990) defines freedom as "the right to determine our own destiny as individuals" (p. 270). If, as Foucault suggests, our very thoughts and acts are destined by power, then only when power is wrestled with, deconstructed, laid bare, and exposed for what it is and what it does in lives can one begin to "think differently than one already knows" (Gillan, 1987, p. 153). When this happens, destiny opens and we can become free. What is Foucault's project? I return to the very first statement by Foucault I read:

> It seems to me the real political task in a society such as ours is to criticize the working of institutions which appear to be both neutral and independent; to criticize them in such a manner that the political violence which has always exercised itself obscurely through them will be unmasked, so that one can fight them. (Foucault, quoted in Rabinow, 1984b, p. 6)

The object of this warfare is individual freedom. The implications of this conflict and possible locations where this struggle might take place in science education curriculum-discourse will be explored in Chapter 5.

The Dynamics of Interviewing

It is clearly inappropriate post-modernly to attempt to replicate Foucault's archaeological methods, since this would amount to structuralistic adaptations of Foucault's work. Instead, Buck & Osborne (1990) suggest Foucauldian deconstruction in educational re-search can occur with some "aspects of Foucault's style" (p. 179) by using "strategies similar to those which Foucault used on his own deconstructions" (p. 179). Foucault's style is simple. When asked how he chooses which historical documents to use in his own research, Foucault (1966/1989f) replied, "I will respond by saying that in fact there must not be any privileged choice. One must be able to read everything" (p. 3). Foucault's thoroughness in research inspired me to gather every written trace of the evolution of Science 10-20-30 I could find, but my archaeological research had access to a type of text Foucault did not: the living memories of individuals involved in a curriculum-discourse.

Journal entries and notes from early January, 1991 on my research approach to interviews demonstrates the power of the technical-rational model. At that time I considered interviewing as process where procedures of power in a curriculum-discourse would become evident through a linear, rational inquiry process that involved a set of definite steps:

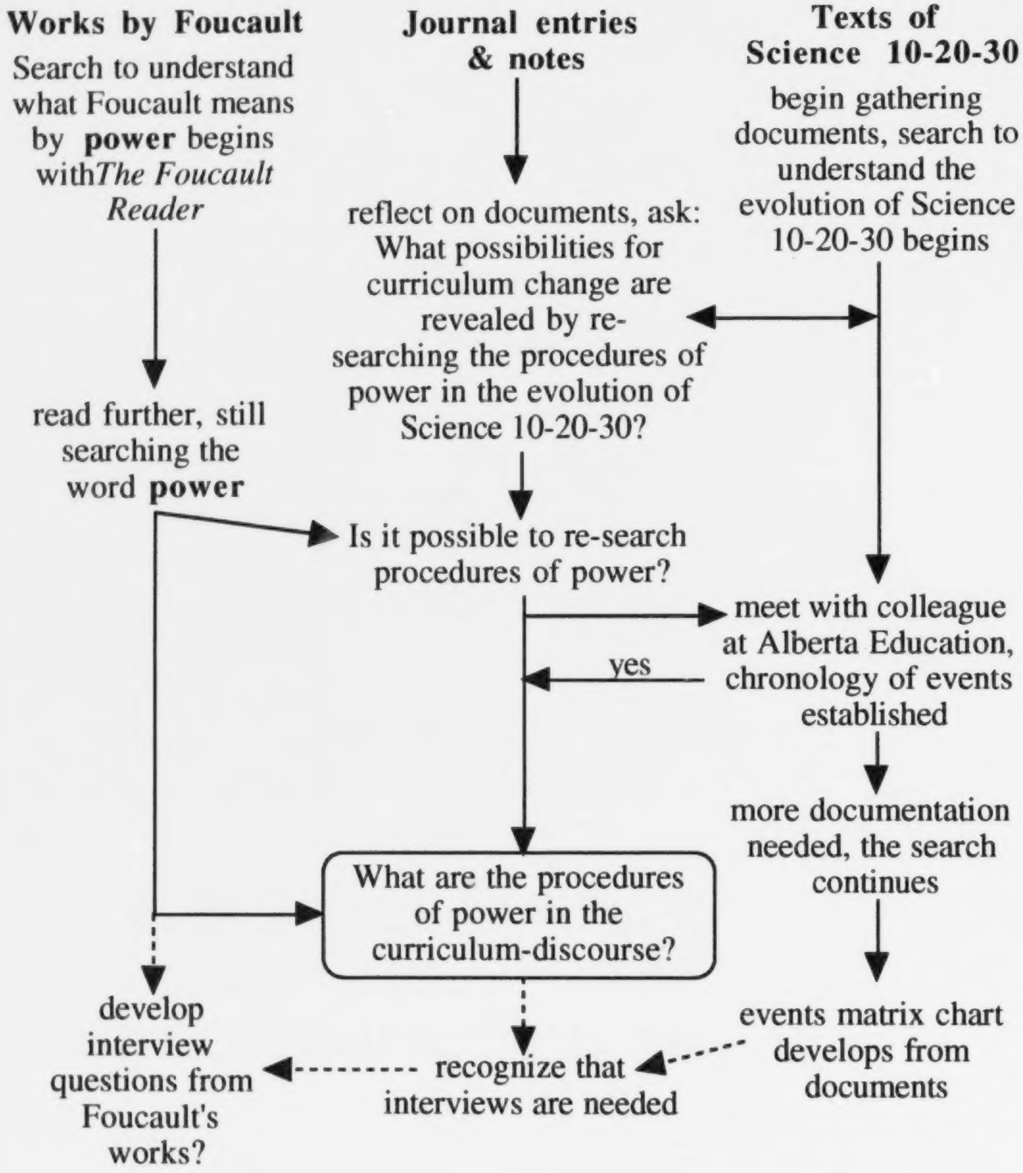
1. Drawing up a set of interview questions based on Foucault's work.
2. Gathering answers to these questions through interviews.
3. Using these answers, along with the documents I gathered, to discover procedures of power in a curriculum-discourse.

My thinking indicates a fundamental belief in progress through rational technique, in my case questioning strategies. Even as I was working at deconstructing technical-rational approaches to curriculum change, my interview strategies were based on technical-rational presuppositions! This fall into technicality was an easy act, arising from many years of participation in educational discourses which are dominated by technical thinking. The ability of this thinking to pervade my own, even as I sought to work against it is a good example of what Foucault calls power. This power encouraged me to split theory and practice in my thinking: my theoretical understanding of the dynamics of a curriculum-discourse, even my theoretical understanding of the need to deconstruct this discourse, was not related to my research practice! This condition did not last long, however. Two events during the first weeks of the new year were to help me break my technical approach to interview research, setting in motion conversations that were to reveal procedures of power in the evolution of Science 10-20-30.

Rethinking Interviewing

In early January, 1991 Heidi Kass suggested I share my research proposal ideas with other graduate students meeting in a weekly seminar. This professor also recommended I try presenting a summary of my research project with some form of graphic. This seemed a good idea at the time and I devoted most of my day to trying to design in my journal a diagram of my research progress. What developed was a messy series of double arrows, lines, and circles. Figure 3 on the next page is a much more tidy representation of what I drew in my journal that day. This diagram re-presents a rather gross oversimplification of my thinking and the evolution of my re-search by January, 1991.

Figure 4. Development of a Research Project.


Works by Foucault
Search to understand what Foucault means by **power** begins with*The Foucault Reader*
read further, still searching the word **power**
develop interview questions from Foucault's works?
Journal entries & notes
reflect on documents, ask: What possibilities for curriculum change are revealed by re-searching the procedures of power in the evolution of Science 10-20-30?
Is it possible to re-search procedures of power?
yes
What are the procedures of power in the curriculum-discourse?
recognize that interviews are needed
Texts of Science 10-20-30
begin gathering documents, search to understand the evolution of Science 10-20-30 begins
meet with colleague at Alberta Education, chronology of events established
more documentation needed, the search continues
events matrix chart develops from documents

Two lessons emerged from preparing this chart. First, I found educational re-search an untidy endeavour, not at all amenable to easy flow charts or technical-rational logic! Second, a graphic representation of progress sometimes leads to insights. In my case, I quickly realized I was experiencing the destining of Ge-stell. My research questions were initially developed through engaging in a type of conversation between Foucault's works and the documents I gathered, but when procedures of power in the science education did not immediately become clear in this conversation, I thought of *using* the procedures of power presented in Foucault's works to formulate my interview questions. Until I prepared a graphic of this act, I did not realize that using Foucault this way was precisely modernistic: I had assumed power in every discourse functions through the same set of procedures. So, in essence I was heading in the direction of establishing a meta-discourse on power supported by research, a thoroughly modern, technical action! If I were to remain open to my original research question (see page 97) I would have to reconsider my interview approach.

Miles & Huberman (1984) recommend interviewing as one way to clarify trends and relationships that appear tepid or fuzzy (pp. 226-227). Their advice prompted me to consider interviewing as the introduction of a new set of texts in my search to understand the evolution of Science 10-20-30 and then research these texts to discover procedures of power in science education curriculum-discourse. This meant interviewing would need to proceed through two steps. The first step would involve a chance for people involved in the curriculum discourse to "tell stories of those lives" (Connelly & Clandinin, 1990, p. 2). I would collect these stories and, in conversation with Foucault's works, re-search for the procedures of power emerging from the stories and documents I gathered.

Connelly and Clandinin (1990) recommend an interview procedure where meetings are "conducted between the researcher and participant, transcripts are made, the meetings are made available for further discussion, and they become part of the on-going narrative inquiry" (p. 5). Kidder (1981) suggests the first requisite for beginning this conversational process is an effort by the researcher "to create a friendly atmosphere and to put the respondents at ease" (p. 179). I decided meeting respondents at a location and time suitable to them might help create an open, inviting situation. To help our conversation begin, I drew up the following general questions:

1. How would you describe your involvement in the genesis and/or evolution of Science 10-20-30?
2. The evolution of Science 10-20-30 has progressed over a number of years. Which stages can you identify in this evolution?
3. Which events (political, social, economic) do you feel played major roles in the genesis and evolution of Science 10-20-30? How were the events involved in the the genesis and evolution of Science 10-20-30?

Even before I began conversations with people involved in the science education curriculum-discourse I realized the questions asked during this initial meeting could vary from this general set depending on the individual. Any specific questions I intended to ask during conversations arose from questions I had gathered from my reading of the documents arising from the Science 10-20-30 program initiatives. For example, documents suggest the Minister of Education formed an Advisory Committee to deal with controversy over changes to the high school science program in Alberta, but was the formation of this committee some sort of political strategy? I decided I would ask the Minister of Education during our first conversation together.

In spring, 1991 I prepared a preliminary list of individuals to contact about beginning re-search conversations on the genesis and evolution of Science 10-20-30. Documents were helpful in identifying some of the most public figures in the curriculum-discourse, but my years as a participant-observer with Alberta Education taught me that behind a document or newspaper clipping is often some hidden story. For example, I had written entire sections of an Alberta Education publication on thinking skill development even though the publication does not report my involvement in any way. This is fairly common in government; many people contribute to a document that might list only one author. Authors "behind the document" may have stories that shed light on the procedures of power in a curriculum-discourse. I asked some of my colleagues at Alberta Education to suggest people I would want to talk to, and with their advice and what I gleaned from documents I added to my original list of potential candidates to interview. Through the review of documents and consultation with Alberta Education personnel I eventually formed a list of eighteen candidates for conversations that included employees of Alberta Education, academics, secondary school science teachers and other members of the educational community in Alberta, and members of the publishing community involved in the Alberta science education curriculum-discourse.

Establishing validity

Conversations began October, 1991. To help these conversations become research I audiotaped our first meeting, transcribed the tape recording, and then use this transcription, along with the events matrix chart, to discover procedures of power in a curriculum-discourse. But how could I ensure the procedures of power I identified would be a reliable perception of the curriculum-discourse? Johnson (1987) reminds us that "perceptions shape human attitudes and behaviour; their impact is persuasive and unavoidable. They provide bases for understanding reality-objects, events, and the people with whom we interact-and our responses to them" (p. 206). I decided to ensure the reliability of my perceptions of power in the curriculum-discourse by allowing my conversations with those I interviewed to continue over several meetings, focusing on the procedures of power I identified after our first meetings.

Establishing and then validating the procedures of power I discovered involved several steps. First, I met with each person individually. At these meetings individuals were asked to share their perceptions of the evolution of Science 10, 20 & 30 by responding to the three general questions listed above. In every case, interviews deviated from these general questions as individuals amplified certain points or shared particular stories. Most initial meetings were one to two hours in length, although a few were longer. Every conversation was audiotaped; before the meeting each individual was asked for permission to audiotape our meeting and permission was granted in each case. I then prepared a literal transcription from the tape and listened to the recording once again to correct errors in transcription.

The next step involved a deconstruction of the transcription using summary notes I made from studies of Foucault's works. The purpose of this deconstruction was to discover procedures of power in the curriculum-discourse. The summary notes I used are quite extensive and are listed fully in Appendix D of this dissertation, an outline of these questions appears below:

1. How does this system of curriculum-discourse present an effective system of exclusion?
    - A. What limits are imposed on what can be said?
    - B. How does this system render participants neutral socially and politically?
2. How is division and rejection used in the discourse? Who is suppressed? Repressed?
    - A. How was division and rejection maintained as a procedure by the construction of social relations?
    - B. How was discourse institutionalized?
3. How is a sense of true and false part of discourse dynamics?
    - A. What major narratives exist (as truth statements?) What is the functioning of these narratives?
    - B. How were truths maintained in this discourse?

4. In a specific type of discourse on science curriculum, what is the most immediate, most local power relations at work?
    A. What forms of knowledge/power exist?
    B. How does the transmission of knowledge play a role in power?
    C. How does power exist as a matrices of transformations- shifting, mutable, and plastic?

The deconstruction of each interview using these questions led me to discover a set of procedures of power that operated in the curriculum-discourse. Sometimes these procedures were similar to those Foucault articulates, such as the production of truth, but new procedures Foucault does not articulate also became apparent as I interpreted each interview in conversation with Foucault's works. Each interpretation was typed and then given to the person interviewed for validation. Some did not wish a second meeting, trusting me to interpret our conversation fairly. Others requested we continue our conversation via notes written on interpretations of our conversation I sent. I met with the majority of individuals a second, and occasionally a third time to discuss the interpretation. These successive meetings with individuals were also recorded, and the transcriptions used to validate the original interpretations which were then corrected and sent back to the individual. If needed, a new meeting took place but most of the individuals elected to send me corrected copies of the latest interpretation. Eventually agreement on interpretations were established and I searched the interpretations for similarities in the procedures of power identified. I describe in my journal the interpretation process as "lengthy but really fun" (Journal entry, November 24, 1991) after completing the first one. This opinion was to change as weeks became months while I worked at the other interpretations!

While working on my first round of interpretations, however, I came to face an ethical issue that threatened to stop my research completely.

Ethical Considerations

My journal entry in early November, 1991 records that "my work on interpretations has encountered a real snag" (Journal entry, November 6, 1991). I note the issue "marries ethics and validity into something personal and difficult. This is not a problem I could have anticipated" (same entry). The concern expressed in this journal entry began with my first interpretation of a conversation with an employee of Alberta Education. As I read the transcript of our meeting and reflected on the works of Foucault I discovered a very clear portrait of the procedures of power in the evolution of Science 10-20-30. Some of the procedures were similar to observations on power by Foucault, others I believe to be unique to the science education curriculum-discourse in Alberta at that time. As I note earlier, to validate my interpretation I was planning to share the procedures I identified with my colleague, together revising the interpretation through further conversation until we reached agreement. I note in my journal the dilemma I faced validating my research interpretations:

> There are *people* here. These people are more than acquaintances. The friendship I've experienced allows unique entry into the discourse at many levels--but trust is part of this entry. My interpretation reveals a whole set of ideas, thoughts, rituals, methods which implicitly are at work [in the discourse], how will [names deleted] feel? These impressions are mine and not valid unless confirmed by those who are, in fact, part of the discourse! But by giving my interpretation I'm also exposing the discourse to what it is--I'm deliberately trying to open a crack in the frame and, in the process, invite others to push on it. (Same entry, emphasis in text)

In Chapter 2, I mentioned that Alberta Education as corporate individual does not exist, in the sense that one can not speak of Alberta Education doing anything; it's the people working within an institution called Alberta Education who act. Speaking of an anonymous Alberta Education diffuses the fact that behind events and documents are the lives of individuals, many my friends and colleagues. This is, of course, a dilemma in participant-observation research since "an observer cannot observe without altering what he [sic] sees" (Zukav, 1979, p. 92). Through involvement as a participant in the science education curriculum-discourse I could not help but affect the events I was researching and the lives I touched, perhaps in positive ways, perhaps not. This thought paralysed my research but galvanized by thinking: Do I have the right to continue my research conversations, knowing they may well initiate conversations of critique in the lives of the people I engage in conversation?

I sought advice on this issue. Over a long coffee break one day with Wallie Samiroden, a professor in our department, I explored the implications of the ethical issues I faced. In our meeting this professor helped me identify two questions I would need to address before I could continue with my research. The first concerned my list of potential people for research conversations. Wallie asked why my name wasn't on this list, since I too was very involved in the curriculum-discourse. This was a good question, I had to admit. J. Simon (1969) argues that in order to understand the full complexity of events, "you have no alternative but to get yourself involved as a person" (p. 207). I was involved directly in the Science 10-20-30 curriculum-discourse as a writer of the introductory chapter of the textbook to accompany the new Science 10 course, author of sections of the Teacher's Resource Manual for Science 10, critical reviewer of the developing Visions 1 textbook, and recently as author of the Visions 1 Teachers' Guide. Popkewitz (1988) argues understanding our roles in curriculum-discourse is essential to understanding how power enframes curriculum-discourses:

> While we are immersed in our personal histories, our practices are not simply the products of our intent and will. We take part in the routines of daily life, we use language that is socially constructed to make camaraderie with others possible, and we develop affiliations with the roles and institutions that give form to our identities. We speak not only as ourselves but, as Foucault reminds us, as part of discourses of power as the social complexities and subtleties of intellectual life are inter-related with institutions. That which is seemingly normal and natural about our participation in the world are the very acts about which we need to become curious and critical. (p. 379-380)

Grumet (1981) suggests keeping an autobiographical journal has tremendous potential to yield deep, critical insights into curriculum experiences. Subsequent reflection, or 'reconceptualization' of these insights requires the writer to be an "active interpreter of his [sic] past" (p. 144). Fortunately, I had been keeping an autobiographical journal for several years and I decided to use my entries to 'self-interview' my involvement in the Science 10-20-30 curriculum-discourse. Any inquiry into human events produces a discourse which Foucault (1988/1978) reminds us, "can no way be dissociated from the exercise of power" (p. 106). Foucault suggests this presents less of a problem and more of an opportunity to discover how power, truth, and knowledge circulate in our own lives. The process of discovery may not be very pleasant, however. For example, I have shared in this chapter through my journal entries how I came to realize that I also was enframed by technicality during my involvement in the evolution of Science 10-20-30.

The second question posed by the Wallie that afternoon was more difficult: What is the responsibility of the researcher in education? My immediate reaction was to emphasize the responsibility of the researcher to ensure the search for freedom in the research act does not directly cause "harm or punitive action" (Patton, 1990, p. 213) to those willing to be involved in the research (Foster, 1990). In my case, many of the individuals I wished to engage in conversation were still employed at Alberta Education. To have their confidence in conversation meant I would need to present the procedures of power I identified without necessarily referring to the individual interviewed. I anticipated this ethical concern even before meeting with Dr. Samiroden, treating all beginning conversations with strict confidentiality. I continued this policy; every conversation began with a presentation of the purpose and nature of the research, assuring those I met of their right to withdraw any comments made during our conversations, or the conversations themselves, from my research until the results are made public in the form of this dissertation. Individuals were asked if they wished their identity protected; only two of the eighteen interviewed wished to be identified by name with their comments, the rest were satisfied to be given the general labels I refer to in Chapter 1. The location and institutional role of the individual is important to understanding how power functions in a curriculum-discourse, thus general titles, such as Seconded Associate with Alberta Education or Member of the Publishing Community are used in my interpretations and care was taken to not reveal particular individual idiosyncrasies of speaking that might reveal the identity of individual.

The responsibility of the researcher involves more than protecting the identify of those involved in the research act. Wallie's question forced me to consider *who I am* in the research act. This act, my act, of researching is, after all, performed by an experienced teacher and researcher engaged in advanced study. I can not avoid the fact I am an intellectual engaged in a research act (Giroux, 1985). After my meeting with Wallie I returned to Truth and Power, the very first essay I read by Foucault (1972/1980). In this essay Foucault suggests in society the intellectual "is not the 'bearer of universal values'. Rather, its the person occupying a specific position--but whose specificity is linked, in a society such as ours, to the general functioning of an apparatus of truth" (p. 132). By "truth" Foucault refers to those elements in discursive practice that make power possible. We are subjected, claims Foucault, to "the production of truth through power" (p. 93). Cherryholmes (1985) paraphrases Foucault's notion of 'truth' the following way:

> If what can be stated is regulated by discursive rules and practices, what can be true or false is so regulated. The existence of constraints on what can be uttered and, thus, on what can be true is one mechanism by which power and truth interweave. (Cherryholmes, p. 52; see also Foucault, 1972/1980, p. 131.)

Since intellectuals are specifically linked to institutions intimately involved in the production of truth, Foucault (1972/1980) suggests "it is necessary to think of the political problems of intellectuals not in terms of 'science' and 'ideology' but in terms of 'truth' and 'power'" (p. 132). Precisely because intellectuals operate and struggle "at the general level" of what Foucault calls the "régime of truth which is so essential to the structure and functioning of our society" (p. 132) hope for change exists in that intellectuals can ascertain "the possibility of constituting a new politics of truth" (p. 133). If, as I have suggested earlier, freedom means being able to break from the destining of enframing, and if this enframing is made possible through the dynamic nexus of truth, knowledge and power, then intellectuals not only may play a role in deconstructing truth in discourse, intellectuals *must* be involved in a critical, post-modern, deconstructive research if change is to happen. The implications of this belief are explored in Chapter 5.

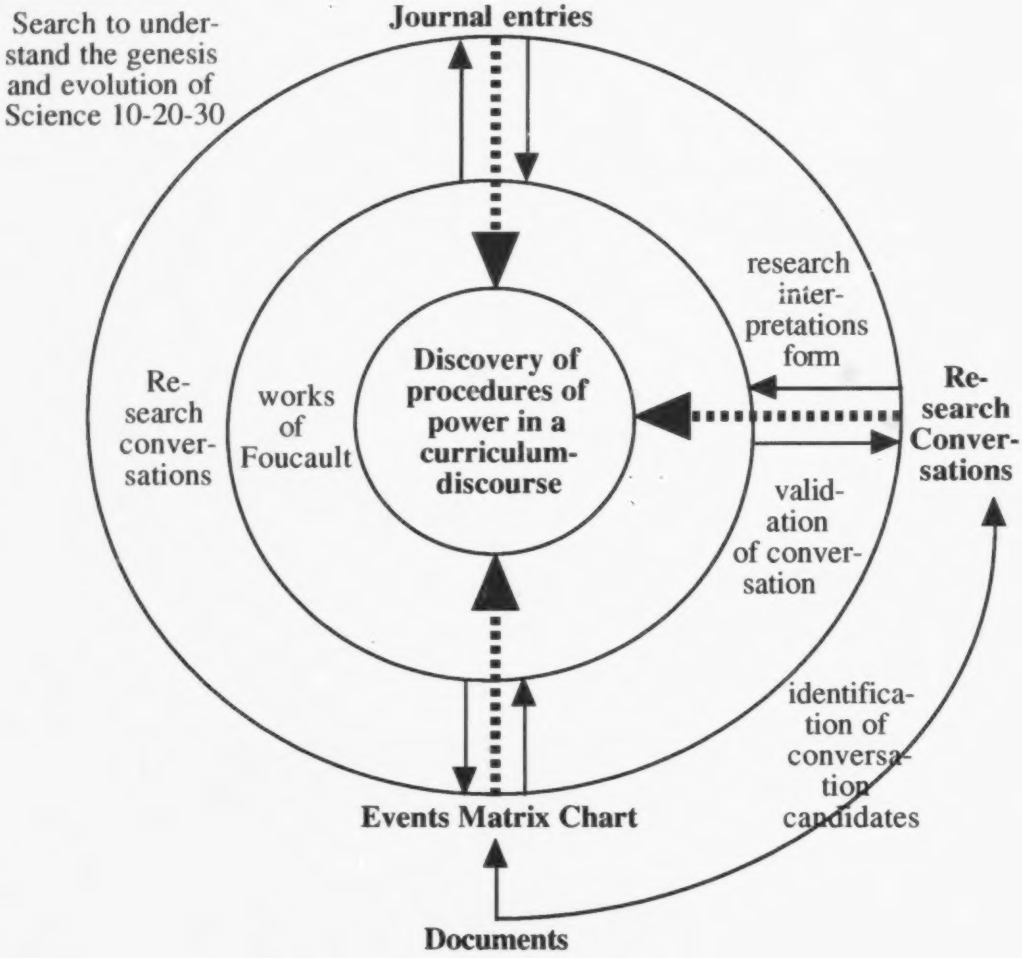
I thought of all the students I once taught, and all the students I was influencing teaching their teachers. The world these children inherit desperately needs the skills, attitudes, and understanding these children could develop through new science curricula. In this great need, change is blocked by a tradition of thinking and being mediated by truth, knowledge and power. *Through my re-search interpretations I had the opportunity to introduce into the on-going science education curriculum-discourse conversations of critique.* As an intellectual engaged in re-search, to have stopped at this point in my re-search would have been unethical and irresponsible to my role and position as a scholar and my calling as teacher in education. I decided to press on with my research, sharing my interpretations with people willing to enter into conversations with me about the evolution of Science 10-20-30 and the procedures of power that support the status quo.

An End and a Beginning

By late spring, 1992 I had directly engaged in extensive interviews with many of people involved in the genesis and evolution of Science 10-20-30, continued my studies of Foucault's works, and reviewed the journal entries I had made since coming to study at the University of Alberta. Guba and Lincoln (1982) suggest "when various bits of evidence all tend in one direction, that direction assumes far greater credibility" (p. 107). What I discovered when I compared interpretations of interviews and examined documents was the consistent appearance of eight procedures of power and two characteristics of power and some procedures of power unique to individual interviews. I have chosen to focus on those procedures of power that were consistently observed, discussing in the next chapter how each procedure of power operated and the two characteristics of power in a curriculum-discourse that I discovered.

I originally set out three years earlier to try and understand the development of Science 10-20-30 in Alberta. Over time, I became involved in a project seeking to discover the procedures of power that function to prevent curriculum change. This research journey demonstrates we can not separate ourselves from our research act; re-search is not a straightforward process or a series of steps towards a goal identified before beginning. Research, in my experience, is an exploration into unknown territory, a 'searching again' motivated by hope and possibility of freedom from the destining of technicality. My research journey was conducted primarily through conversations, allowing interpretations to emerge through continual dialogue with Foucault through his work, stories of those involved in the science education curriculum-discourse, documents I gathered re-presented in an events matrix chart, and my own story presented in the text of my journal entries. Figure 5 on the next page diagrams the progression from a search to understand the genesis and evolution of Science 10-20-30 to research on the procedures of power in the evolution of Science 10-20-30, although it is important to remember, as I mentioned earlier, that graphic portrayals suffer the limitations of simplicity and superficiality.

Figure 5. Dis-covery of the Procedures of Power in a Curriculum-Discourse.


Search to understand the genesis and evolution of Science 10-20-30
Journal entries
research interpretations form
Re-search Conversations
Re-search conversations
works of Foucault
Discovery of procedures of power in a curriculum-discourse
validation of conversation
identification of conversation candidates
Events Matrix Chart
Documents

And so we come to the end of my narrative, but to the beginning of hope in our conversation. That summer, I left Alberta and my life as a student to become an Assistant Professor of Curriculum Studies at the University of Saskatchewan in the city of Saskatoon, Saskatchewan. I came to the University of Alberta four years earlier interested in philosophy, became captured by the problem of curriculum change and left the province a person deeply enriched and changed from my many experiences. I also was able to discover how power prevented curriculum change in senior science education in Alberta. Foucault (1984a) prophesied that once the procedures of power in a discourse were discovered, one could find ways to fight the frames that bind us. Sadly, Foucault died before being able to fully explore the practical implications for action arising from his archeological projects. We have the opportunity, however, to continue aspects of Foucault's project of hope and freedom in an education discourse, beginning in Chapter 4 with the discovery of the procedures of power in the evolution of Science 10-20-30 in the science education curriculum-discourse of Alberta.

CHAPTER 4
THE DESTINING OF POWER IN A SCIENCE EDUCATION CURRICULUM-DISCOURSE

Introduction: Wrestling an Angel

Let us continue our discourse on curriculum change with a midrash from the life of the ancient Biblical figure Jacob. A midrash provides, usually through the creation of allegorical narrative, "interpretations of particular words, letters, and modes of writing" (Jacobs, 1984, p. 22) of a discourse, usually Biblical, that lead to certain insights and lessons for living. In our case, an unusual event in the life of Jacob leads to a midrash that provides a metaphor that can take our discussion on the procedures of power in the science education curriculum-discourse in Alberta and curriculum change in general a step further.

First, a context for this midrash. Jacob is the grandson of Abraham (c. 2000 B.C.E.),[1] the Biblical founder of the Jewish people. According to the Bible, God promises Abraham the land of Canaan, present-day Israel, as an inheritance. Patrilinear inheritance was traditional Middle East practice, thus Abraham's grandson Esau inherited the same promise from God. Jacob, Esau's twin, was born moments after his brother. When the twins became young men, Esau, famished from hunting, sold his birth-right to Jacob for some of Jacob's food. Later Esau came to regret this rash act, vowing to kill his brother in order to regain the birth-right. Hearing of his brother's threat, Jacob fled to the East to work for his uncle. Twenty years pass and, according to the Biblical account, God instructs Jacob to move with his wives and children to the land promised to Abraham. Just before crossing the stream that bordered this promised land, Jacob sends messengers asking forgiveness from his brother Esau living just south of the stream. Jacob's messengers return with news: "Your bother Esau is coming to meet you, and four hundred men with him" (Creation House, 1973, New American Standard Bible (NASB): Genesis 32:6). Jacob was terrified, forced to decide if he should cross the stream, possibly risking his life and the life of his family at the hand of Esau's force the next day, or turn back to the security of his former life. He spends the night in crisis.

It is the odd events of this night that we shall consider. The passage reads:

---

[1] i.e., "Before the Common Era," essentially the same as the Christian designation B.C., "Before Christ."

> Then Jacob was left alone, and a man wrestled with him until daybreak. And when he saw that he had not prevailed against him, he touched the socket of his thigh; so the socket of Jacob's thigh was dislocated while he wrestled with him. Then he said, "Let me go, for the dawn is breaking." But he said, "I will not let you go unless you bless me." So he said to him, "What is your name?" And he said, "Jacob." And he said, "Your name shall no longer be called Jacob, but Israel; for you have striven with God and with men and have prevailed." (Creation House, pp. 49-50: Genesis 32: 24-28)

The man Jacob wrestled with is traditionally interpreted as an angel (Kline, 1970) sent by God; Jacob's prowess in wrestling this heavenly messenger led to the blessing of Jacob's name becoming Israel. But this makes little sense. First, Jacob's adversary is called in Hebrew, *Yish*,[1] which refers to a man and not necessarily an angel at all. Second, even if the opponent were angelic, how could Jacob, a mere mortal, actually be winning the match so that, in a sense, the angel has to cheat by supernaturally dislocating Jacob's thigh? Third, how is being named Israel, literally, he wrestles with God, any sort of blessing?

But suppose the man Jacob wrestles was himself? The Hebrew text itself then provides a midrash for us and a new light shines on the passage: In torment, Jacob spends the night alone wrestling with the decision to go ahead and seize the blessing, with associated dangers, or to return to what once was. During this time of intense struggle, Jacob was not able "to prevail," which can also mean, "to understand, comprehend." For most of the night, Jacob's wrestling did not lead him to find direction. At this dark point in Jacob's life his thigh was "touched." The word for thigh can also refer to an innermost place of our being, "touched" more correctly rendered, "struck." In the dark still, Jacob had to strike into his innermost being to find his way. Then, as the sun appeared, the man Jacob's wrestles calls out, "Let me go," or more correctly, "Let me be free." Jacob knows this freedom is possible and he is unwilling to move until a blessing comes to him. What is the blessing? Change. Jacob realizes change is possible, but it is not enough to work on the surface: one must wrestle alone in a deep, difficult struggle that may be painful. As the dawn breaks, Jacob faces a question: "What is your name?" The word name can also mean "essence"; thus a critical question anyone must face contemplating change emerges from our midrash: "What is your essence?" Jacob can no longer be Jacob; he has chosen to wrestle in his life and in this struggle Jacob becomes a new person, he is no longer Jacob but Israel. The dawn breaks as Jacob limps over to his promised land to claim his inheritance, in some pain from his change but able to face his fear of Esau; Jacob is free.[1] This freedom of change is not easy, but the account of Jacob and the angel teaches us it is possible. But in order for change to be possible we first must wrestle.

---

[1] אִישׁ, from the text in Sinai Publishing, 1984, p. 73.

Allegory and Post-modern Dis-covering

> It is our business not to supply reality but to invent allusions to the conceivable which cannot be presented.
> Leotard (1979/1984), The Post-Modern Condition, p. 81.

Paradox and Possibilities in Post-modern Writing

Many facets of human experience are not easily explained, depicted or presented through printed words. For example, while I know from my experience how I feel when a group understands for the first time an important concept I am teaching, I have trouble writing out what precisely what this feeling is. There are elements of joy, to be sure, certainly satisfaction, often surprise, always delight; but these adjectives fail to capture the moment, they are but shadows of something else. I call this inability to exactly capture ideas the poverty of words. The paradox and possibilities of this poverty becomes apparent in the attempt to write text post-modernly.

What does it mean to write post-modernly? To understand the paradox and possibilities of post-modern communication, we first must explore briefly the purpose of text in modernity. One of the central goals of modernity is the achievement through rational inquiry of "a basic, fundamental knowledge" (Madison, 1990 p. x) of an existent world external to self. This research agenda rests on the positive presupposition that this basic, fundamental knowledge *can* be obtained, concomitant with the belief that clear, representative communication of this knowledge is possible, and that this knowledge can be used to further human progress (Mercer, 1990; Rosenau, 1992; Vattimo, 1985/1988). In modernity writing is thus a technical act involving careful delimitation and definition of terms towards achieving a sense of closure of meaning between the text and the reader (W. Doll, 1992). The ultimate goal, then, of communication in modernity is absolute flawless communication between the author and reader via the representation of the world through text. The dream of the modern philosopher, explains Boyne (1990) is a universal language for humankind which would be

---

[1] To read about the meeting of Jacob and Easu after twenty years of separation, refer to Genesis, Chapter 33.

> a perfect reflection of the real world. The utter perfection of such a language would be marked by its utter transparency. It would in no way obscure or distort the world which it represented. (p. 91)

This quest for perfect, objective communication is a hallmark of our modern era. While such a task may initially seem futile or even naive, the belief that "I know what you mean" is more than cliché in modern communication whether speech or text: We often live out daily the modern assumption that when reading a text or hearing someone speak *we fundamentally are receiving a reasonable version of what the author means and how the world is.* Thus, text is assumed in modernity to be objective in the transfer of meaning.

But is an objective access to meaning through text possible? In the latter part of this century philosophers such as Barthes, Blanchot, Foucault, Gadamer, and Heidegger, to name a few, have challenged the modernist presupposition of a rational representation of meaning. Perhaps the most virulent and consistent attacks on modernistic views of communication have come from the French philosopher Derrida. Cupato (1987) captures the essence of Derrida's argument well:

> whatever unities of meanings are constituted in natural languages, whatever normalized form experience assumes, whatever institutionalization our practices receive, all are alike vulnerable, alterable, contingent. They have not fallen from the sky; they are structurally, eidetically vulnerable, however much they have tended to gain acceptance.[1] (p. 144)

To argue that communication is a contingent, particular, open and vulnerable to interpretations event is to move from modern towards post-modern thinking. I will not attempt to define post-modern, as Huyssen reminds us, "the term *postmodernism* itself should guard us against such an approach" (p. 236, emphasis hers). Instead, I will use this word as a "breaking away" (p. 236) from modernity within modernity, an attempt to distance discourse from the metaphysical privilege of theoretical thinking (Gruber, 1989). From a post-modern perspective, the notion of an objective meaning represented by any text is an "ultimately unacceptable fantasy" (Boyne, p. 91) with an underlying sinister element. For the notion of objective meaning-making and transfer leads inexorably to the terror of totalizing narratives of the world, or "metanarratives," that define what may be spoken and how this speaking is to be understood (Lyotard, 1979/1984; Mercer, 1990; Milner, Thomson & Worth, 1990). It is these metanarratives, suggests Foucault, which serve "normalize individuals through increasingly rational means, by turning them into meaningful subjects and docile objects" (Foucault, quoted in Dreyfus & Rabinow, 1982, p. xxvii). So, although somewhat an oversimplification of the post-modern point, Foucault and others argue the modernistic belief in objectivity in communication and realism in representation of the world through text provides opportunity, ultimately, for the objectivication of human life, a modern destining of technicality which Heidegger (1954/1977) declared is fundamentally *dangerous*.

---

[1] Derrida uses the word 'eidetically' to refer to the generation of abstract representations believed to capture the essence of reality. The addition of 'vulnerable' suggests such abstractions, common to phenomenological inquiry, are suspect.

Yet we live with each other. And, in the case of our particular discourse, for the sake of our children and the future the need for change in the curriculum-discourse of science education compels us to continue to find post-modern ways to communicate. But can this communicating be meaningful if the words I choose are divested from objective meaning? More to the point of the discourse of this dissertation before you: If I have dis-covered what I call "procedures of power" in a particular curriculum-discourse, and if I believe it important to realize how these procedures operated to secure the status quo and thus prevent change, how can I present these procedures in a way that opens, not closes meaning, in a way that does not present a metanarrative on curriculum change? Can an author speak post-modernly through written words?

This speaking might begin with a break from the tradition of modernism through the rejection of "conventional, academic styles of discourse" (Rosenau, 1992, p. 7) often dependent on rational argumentation and increasing focus to secure meaning. Instead, authors attempting to write post-modernly might employ "audacious and provocative forms of delivery, vital and intriguing elements of genre or style and presentation" (p. 7). To find interruption in the act of reading, parts of words may be surrounded by parentheses, sudden and unexpected use of punctuation and/or breaks in text may appear, graphic arrangements and clever imagery could be used to give the text a sense of performance, rather than objectivity. This variety in presentation is designed to "shock, startle, and unsettle the complacent social science reader" (p. 7) with the intention to "instigate the new and unaccustomed activity of post-modern reading" (p. 7). This reading takes meaning from statement to question, demanding the reader "face up to the difference and difficulty which enter into what we think and do and hope for" (Cupato, 1987). In other words, from a post-modern perspective meaning exists in a multiplicity--as meanings--between the space formed as questions emerge between the author's presentation and the reader's reading. Text becomes more than words on a page, but an *invitation* to consider what it means to live through constant, never-ending negotiation, revisiting, and reflection on what the author has given to the reader. Thus the post-modern author, according to Lyotard (1979/1984), assumes

> the position of a philosopher: the text he [sic] writes, the works he produces are not in principle governed by preestablished rules, and they cannot be judged according to a determining judgment, by applying familiar categories to the text or to the work. (p. 81)

The purpose of this writing is to invite radical thinking, to provoke and interrupt the reader so that they may discover the difficulty of life in distance from the comforting and dangerous definitions of modernity.

Clearly this writing is a type of ethical practice, for in committing words to a page the post-modern author calls the reader, like Jacob in the introduction of this Chapter, to wrestle an angel, in this case the presented text, with the conviction that in wrestling comes the blessing of change. Post-modern writing is not an exercise in relativism nor is meaning-making anarchistic. It is the exact opposite: a practice that realizes Being is defined, delimited, and determined by modernity and seeks to find, through text, those who will join with the author in breaking what Heidegger calls Ge-stell. Writing, then, is a struggle for freedom, reading an engagement in the partnership of this quest, meaning(s) somewhere in-between. The result is, as first mentioned in the introduction to Chapter two, an active and continual discourse of "searching, questioning, finding and losing, reaching out to achieve some kind of freedom in a resisting world" (Greene, 1987, p. 12).

Allegory and Metaphor in Post-modern Writing

If post-modern writing is ethical action to open possibilities for freedom from the destining of modernity, then the author has an obligation to not make the presentation *so* strange or (not)familiar the reader becomes bored or unable to make any sense of the text and thus is unable to move into the space created by the text. As Cupato succinctly reminds us, "the point is to make life difficult, not impossible" (p. 7). Thus the post-modern writer has a paradoxical obligation to the reader: to write in such a way that meaning stays open, but also clearly enough that meaning remains possible. Playing (with)in the text may, for some, allow this opening; for others the presentation may simply be silly. I believe two literary devices enable the task of post-modern writing by opening the familiar: metaphors and narrative allegories.

"Metaphors," notes Bump (1985), "enable us to make new connections and see things in a new way" (p. 447). The creation of metaphors opens possibility by prompting questions that further a discourse. For example, the introductions to Chapter 3 and 4 use metaphors to open up questions in our discourse-through-this-dissertation. The introduction to Chapter 3 might prompt the questions such as: How is our modern situation similar to being lost on a precipice in the mountains? Is there significance to using mountains in the metaphor? What might mists depict? Do the voices that helped me find a way off the precipice suggest where hope may lie in our modern situation? In this the introduction uses a metaphorical style called a midrash. Again questions arise: What might the Angel in this metaphor represent in a curriculum-discourse? What acts might wrestling represent? And, foreshadowing Chapter 5: How is becoming a new person related to curriculum change?

But sustaining a metaphor past a few pages can be difficult, although I have demonstrated elsewhere (Blades, 1992b) how a metaphor can be used to suggest possibilities for change in curriculum-discourse. In my effort to dis-close the procedures of power I discovered in a curriculum-discourse I turn in this chapter to a literary method that allows a longer presentation in text while retaining openness in discourse: the allegory. Allegories are a method of presentation in which "a person, abstract idea, or event stands for itself *and* for something else (Shaw, 1972, p. 12, emphasis his). Often an allegory develops a work of fiction where "characters and their actions [are] to be understood in terms other than their surface appearances and meanings" (p. 12). By developing second order meanings in a story, allegories are like an extended metaphor that invites the reader to reflect and question symbols in the text-presentation (Abrams, 1971; Crowell, 1989; Shaw, 1972). Derived from the Greek 'allegorein,' which means to speak as to imply something else, allegories have provided throughout time a way for authors to introduce critique to discourse while avoiding premature closure of meaning. The exploits of Don Quixote, discoveries of Gulliver, Christian's journey as a pilgrim or the obsession of Ahab to find the Great Whale are but a few of the masterful allegories used by authors to present to the public an invitation to discuss something else. For example, while Orwell's Animal Farm (1945) can be read as a child-like story of animals taking over a farm, readers quickly see this work is also an allegory of something else.

Given the richness of and potential of allegories to open conversation, it is perhaps surprising allegories are rare in education writings about curriculum change (Crowell, 1989). Perhaps the dangers of using allegories have encouraged a cautious stance to the use of allegory in understanding curriculum. After all, the point of the allegory may be missed entirely, or perhaps the readers might read into the allegory representations of people, actions, and events the author did not intend... But, wait! These concerns are modernistic. The post-modern author is not responsible for meaning, only for initiating conversations of critique. The reader must consider the extent the destining of modernity influences their response to the presentation of text. Allegories help the author say something else, immediately allowing questioning to surface, rather than closing conversation. For example, I could have chosen for Chapter 4 of this dissertation to present by list and subsequent elaboration the procedures of power I discovered through the research approach outlined in Chapter 3. Certainly such listing is easier than the struggle to develop a post-modern way to write. But a more academic or traditional presentation could be easily appropriated by a modernistic reader as a list of the factors to be considered to ensure a curriculum change proceeds as planned. This appropriation flows from the assumption the procedures I name are generic to other curriculum-discourses, thus (in)forming structuralistic metanarratives about curriculum change. In this way, the destining restriction of possibilities for curriculum change I discover might be served by my presentation of procedures of power in a curriculum-discourse! The only way out of this modern encircling is to find a post-modern way of sharing these procedures, a path of interruption and (hopefully) surprise; a pathway that leads to thinking and questions of critique, not closure and meta-theorizing.

Entering into this type of writing requires me to wrestle as I write, to struggle to find a way to allow openness and stimulate questions as I share the procedures of power I have found. Why bother? I believe with Lyotard (1979/1984) that for too long "we have paid a high enough price for the nostalgia of the whole and the one, for the reconciliation of the concept and the sensible, of the transparent and the communicable experience (p. 81). He continues by calling for the direct challenge to the activity of Ge-stell: "let us wage a war on totality; let us be witnesses to the unpresentable; let us activate the differences and save the honour of the name" (p. 82).

To engage in this most post-modern agenda I present the procedures of power I dis-covered operating in a curriculum-discourse through an allegory of a Quest. The purpose of presenting what I have discovered in an allegorical form is to extend an invitation to journey together as we wrestle with an angel that has for too long limited the freedom to change by defining who may speak in a curriculum-discourse and what may be said. To do this, I revisit through allegorical story the evolution of the Science 10, 20 & 30 program in Alberta. This visitation is a repetition (Kierkegaard, 1843/1983) where our conversation is "recollected forward" (p. 131) through allegorical telling; that is; we recollect the events in the evolution of the Science 10-20-30 programs so that we can move to laying bare the procedures of power at work in the science education curriculum-discourse of Alberta. In this movement, allegorical presentation becomes part of the trachealization of a discourse, a discovering of Ge-stell and, hopefully, a revelation of possibilities for change. The allegory of a quest within a kingdom that follows is thus an invitation to enter into a conversation of critique, a challenge to "surpass the given and look at things as if they could be otherwise" (Greene, 1988, p. 3).

The Quest

The Kingdom was the envy of the entire world, or so we believed. For decades past living memory the Servants of the King worked with characteristic zeal and dedication to transform this realm into a modern, efficient machine. No resource was left to chance; no tree left unmarked for processing, no stone unturned, every idea exploited for material gain. Through technological innovation these Servants helped build public confidence in the King's doctrine of *Prosperity Through Progress*. All citizens had homes, places in society, and expectations of possibilities for their children. The future seemed secure and safe as Servants continued on their relentless course to discern "the knowledge of all causes, and secret motions of things; and the enlarging of human empire, to the effecting of all things possible" (Bacon, 1597/1942, p. 288). We continued to live confident in the King's ability and the collective wisdom of the Servants to solve any problem that might threaten the realm. But then children began to disappear.

No one knows why or where they go. At first, symptoms such as "the decline of literacy, the lack of scientific understanding, the deplorable state of physical fitness, [and] the cancerous growth of the video industry," (Borgmann, 1992, p. 10) seemed to implicate some disease affected the minds of our children. From these initial symptoms the condition became worse as children began to wander in a state of numbness the well-designed streets of the Kingdom. Content with the music of their Fathers, the affected children continued to drift until they became, by almost imperceptible degrees, invisible. I should add not all the children in our Kingdom were affected by the strange malady, making an understanding of this bizarre phenomenon difficult. Some children were able to grow up and thus find a meaningful location in the structure of the Kingdom. But distressing numbers of our children became afflicted by the new, strange condition and, before they could find their place in the Kingdom, these children disappeared.

The situation had reached the point of crisis. Now completely dependent on the vast infrastructure composed of the often inexplicable and intricate scientific workings of the myriad of Servants, the Kingdom- indeed, the very power of the King- was being increasingly challenged by the attrition of aging Servants! As children continued to disappear it became clear somewhere in the hierarchy of the Kingdom that if this trend were to continue there would be less children available to apply for a career as Servants to the King, or even to take their rightful place as citizens in the Kingdom. Some Scholars even argued publicly that at present rates, *all* the children in the Kingdom might disappear in only a few generations. While the general public did not generally believe in these gloomy predictions, still grumblings of concern could be heard in the taverns, town halls, and public meeting places. Some citizens for the very first time boldly suggested the King's power was limited, or even that the King did not know everything important to know. Everyone agreed something had to be done to stop children from disappearing.

Rumours are the King himself consulted with the finest, brightest Servants about the strange malady, but these Servants were not able to explain the phenomenon, much less propose a cure. For a few decades Servants encouraged the initial training of children in Servanthood. The results, despite massive investments of funds and personnel were dismal; in fact, their efforts led to an increase in the rate at which children disappeared! The Priests[1] of the King's Cathedral, responsible to ensure children become active, willing members of the Kingdom through formal instruction, searched their ancient books on childhood phenomena. No reference to the disappearance of children could be found. Government officials met and deliberated, sometimes directly involving the Priests teaching children the basics of Servanthood. Through these meetings it became clear no solution to the disappearance of children could be found among previous tactics or strategies. A few Cathedral officials and Scholars in the Kingdom dared to suggest the resources of the Kingdom were not enough to solve the problem of disappearing children. After much discussion, the Cathedral executive was persuaded to organize a small team of experts charged with the task of travelling outside the Kingdom to see if a cure for the disappearance of the children might exist in another realm. And so The Quest for The Answer to the problem of disappearing children began.

The Kingdom had been so successful dealing with problems that pathways to other kingdoms seemed to exist in mostly ancient legends or the speculation of philosophers. Cathedral officials had maps that led from the centre of the Kingdom but the maps were surprisingly vague at the margins, at least to those who now wanted to travel to this area and beyond. Still, the few Cathedral officials who initiated the Quest believed with firm conviction those on the Quest would be able to find the edge of the Kingdom and answers to the problem of disappearing children in the lands beyond.

---

[1] In our Kingdom, priests can be either gender.

I was late joining the group that actually set out on The Quest, delayed by my apprenticeship as a Scholar. I knew a team from the Cathedral had formed to begin the Quest and I was aware they had reached the first fork in the King's Highway that led away from the centre of the Kingdom. My expertise as Priest and experience with the Servanthood, together with my knowledge of the extensive and often bewildering roadways in the central part of the Kingdom, led to an invitation to join in The Quest. Like many of the Priesthood, I was deeply concerned over the disappearance of children in our Kingdom and gladly accepted the chance to play a role in the success of The Quest.

Before departing I thought it might be wise to take some items with me. I estimated the journey to another Kingdom would be fairly straightforward, so I packed lightly. Aside from the usual travelling necessities and a small tent, I also brought three Scholarly books, a notebook to keep a journal of my travels on The Quest, and a general map of the Kingdom. I left my home on a bright, sunny day and immediately set out on the main road that led away from the centre of the Kingdom.

After a few days I found the group that had embarked on the Quest sitting at the junction where the King's Highway forks. The group was smaller than I expected, composed mostly of a few Career Associates from the Cathedral executive and a handful of Priests seconded to The Quest. This friendly, cooperative and highly talented group greeted me with enthusiasm and invited me to consider the maps they had brought with them for this part of the journey. I admitted the maps were next to useless, not even indicating the fork in the pathway they had just encountered. Prior to my arrival I discovered a major map-making company was supposed to play a key role in The Quest. I was approached by the company to help in the production of a map that would be useful to those on The Quest. Oddly, then, I found myself participating in the Quest and trying to help produce a map for the journey at the same time. To make the challenge even more difficult, no one involved in The Quest knew the exact route out of the Kingdom, although everyone agreed that working together we would find it.[1]

---

[1] A map of the Kingdom tracing the travels of the team is available in Appendix E of this dissertation. This map is *not* the map I originally brought with me on my journey, however. Readers may find it convenient to consult from time to time the map found in Appendix E to trace the route of The Quest.

When I arrived I immediately recognized where the group was located. The fork to the right was called the Great Loop. In a gentle arc this roadway directed travellers back to the city in the centre of the Kingdom via a scenic route along the shores of the Great Lake just outside the central city. The map I brought with me indicated the group must travel along the left fork in the road if they are to leave the Kingdom. I was a little nervous showing my map to the group since the traditional route, and indeed the road more often travelled, lay to the right. However, when I showed them my map the group from the Ministry "loved it and seemed relieved to see it finally on track with what they wanted" (Journal entry, March 25, 1989). I note later in the same journal entry, "it feels good to have helped and to be involved in introducing a curriculum I believe is an important first step towards a science education orientation which is progressive and a better reflection of the way science is being reconceptualized in the world." I joined the party and walked with them along the left fork in the pathway, confident we were travelling on the correct direction towards The Answer.

Procedures of Power in a Curriculum-Discourse

> Power is not an institution, and not a structure; neither is it a certain strength we are endowed with; it is the name that one attributes to a complex strategical situation in a particular society.
> Foucault (1978/1990), The History of Sexuality, Volume 1, p. 93.

We had not travelled far along the left fork when I saw someone standing by the side of the path. It was Michel Foucault. I recognized him from a picture on one of his books. No one else in the party paid any attention to him and simply walked by, but I knew from his writings this Scholar had spent time in the Lonely Mountains at the edge of the Kingdom. These mountains totally enclose the Kingdom and our team would have to eventually find a trail through the mountains to travel to a new kingdom. Surely Foucault would know the pathway that led to new realms, or at least we could benefit from his mountaineering experience. I stayed to visit, intending to catch up to the team later. In Chapter 3 I described how the visit became longer than I anticipated at first and how this philosopher came to travel with me on my journey in The Quest. Thinking back, this rather chance meeting became quite significant as I began to make sense of events during The Quest through my conversations with Foucault. This sense-making is, of course, my own and possibly someone else would discover a different set of procedures of power that affected the direction and success of The Quest.

The previous chapter of this dissertation explains how, in conversation with Foucault, I discovered procedures of power that defined the progress of The Quest. This research act of the trachealization of a curriculum-discourse revealed two general strategies of power. First, procedures determined who could speak in the curriculum-discourse, defining who was able to take part in The Quest. Second, procedures determined what could be said in the curriculum-discourse, defining the route of The Quest. As we shall see, these strategies, possible through particular procedures of power, formed a dynamic system of inclusion and exclusion destined to play a decisive role in the success of The Quest.

Destining Who Can Speak in a Curriculum-Discourse

The modification and legitimation of hierarchies

Foucault and I struggled to catch up to the others on The Quest, now a considerable distance away. As we journeyed toward the team, Foucault asked me the purpose of this journey. I replied that we are travelling out of the Kingdom to find The Answer to the problem of disappearing children. But, I confessed, to our knowledge no one has actually made such a journey successfully. I turned to Foucault and asked, "You've been in the mountains at the edge of the Kingdom. Are there other realms beyond?" I thought I heard him reply that there was, but I could not hear him clearly for the noise behind us.

It was a small, but loud, group of Priests. They had heard of The Quest and were attempting to catch up to the original Quest team now just visible on the horizon ahead. They ran right past Foucault and me. We hurried on to join the team, arriving to intense arguing between the team from the Cathedral and the Priests. One Priest was claimed The Quest was a "trivial" way to deal with the problem of disappearing children (McGeachy, 1989, p. 3). A leader of the group of Priests pointed out that, in the opinion of a certain group of Priests who met to consider the potential of The Quest, the maps the team were using were hopelessly inadequate. The leader insisted that more map-making was needed before the group ventured further (Interview with a Secondary School Teacher, April 29, 1992). Another Priest was calling loudly for the team to abandon the Quest altogether (Armstrong, 1989). Clearly these Priests were upset with the team. As I listened to the concerns of the Priests I realized that despite working within the Cathedral organization, these particular Priests embraced a separate identity from the Cathedral because of their work with children. This defining gave the Priests the freedom to express their conviction the team had made a wrong decision by taking the left fork in the King's highway, thus challenging the authority of the existing hierarchy in the Cathedral organization.

The arguments quickly became personal. Team members suggested Priests had lost confidence in the rightness of the Cathedral executive who were, after all, there to serve the Priesthood and the children in the Kingdom. The Priests countered that only they, closest to the children in the daily activities of the Cathedral, know what is best for the children. Each Priest then tried to impress upon the team the importance of taking the road to the Village that lay ahead, convinced this route would best lead to The Answer. The team members, convinced they were already on the correct route, declared they would not take the right turn ahead that led to the Village. Tension mounted and for a moment neither group spoke. Finally, the team turned and continued on the journey. The Priests returned to their cities, but not before shouting their intention to force the Cathedral organization to change completely the direction of the Quest.

We continued the Quest in relative silence for the next few days. As we walked, the map-making company strove to produce innovative maps to help guide the team. We had to consult these maps often, choosing to remain on the left fork of the King's highway even though this route was traditionally only used in the movement of workers and machinery to and from the industrialized western regions of the Kingdom. Still, our map-makers assured us this route would lead us out of the Kingdom. After only a few days one of the members of the group caught sight in the distance the very peaks of the Lonely Mountains, a certain sign we were moving steadily away from the centre of the Kingdom. As our view of the mountains increased, so too our optimism that we would reach the borders of the Kingdom within a week. Foucault, however, continued to be in a somewhat sombre mood, souring a little the hope I felt at this part of the journey.

Bureaucratization

We had just passed the junction to the Village, when a foul wind began to blow from the western regions of the Kingdom. While we knew the King's factories lay directly to the west, few citizens, unless employed directly by the factories, ever saw the factories, much less smelled the polluted air created by the furnaces that ran constantly. The stench was, at times, unbearable and sometimes we found we could only breathe if we walked backwards, facing the centre of the Kingdom. Still, the team was resolute and no one talked about turning back. Our maps indicated that every step on this part of the King's highway brought us closer to the river on the northern plains that marked the boundary between the beginning of the Lonely Mountains and the end of the King's realm.

After only a few days we were met at a turn in the highway by a large group of officials from the Cathedral. One of the Cathedral executives told us that a problem in The Quest had developed. Apparently some of the Priests involved in the challenge to the the team early in the journey contacted key members of the Servanthood to share their concerns about the direction of The Quest. These Servants then contacted commanders in the King's army. Sadly, in our Kingdom there is no great love between Military and Cathedral organizations, although both institutions serve King and Kingdom well. Military commanders seized the opportunity to complain openly about The Quest in village squares and marketplaces throughout the Kingdom. Understandably, the executive of the Cathedral was concerned about this latest development and decided to "invest a lot more resources towards development" of The Quest (Interview with a Career Associate with Alberta Education, April 24, 1992). These resources included increased funding and involvement of Cathedral personnel in the development of The Quest so that the Cathedral organization could ensure the team continued to travel in the right direction.

The result of this investment was increasing involvement of Cathedral executives in the movement of the team. In some cases, notes one team member, senior Career Associates with the Cathedral "became directly involved" (Interview with a Seconded Associate with Alberta Education, October 21, 1991) in dictating the route of the team. Another team member complained that as conflict about The Quest became more public, "more and more managers were put in charge of the new programs, complicating what had to be done" (same interview). This bureaucratization led to logistic problems in map-making and planning the route for the Cathedral team as "so many different levels in the bureaucracy between Career Associates [name deleted] and the program managers have to be gone through" (Interview with a Seconded Associate with Alberta Education, October 10, 1991).

Increasing bureaucratic organization of The Quest also served to reassure everyone in the Kingdom that the Cathedral was fully in control of the direction of The Quest. All new maps had to now be approved by the Cathedral executive who collectively decided to not allow further travel by the team unless it was "well thought out, well resourced, and ready to go" (Interview with a Career Associate with Alberta Education, November 7, 1991). Over this part of the journey Cathedral officials began to accompany the original team members, informed by runners that continually brought messages to the team from the Cathedral executive.

A message came a few days later that the team was to take the first possible right turn. Those travelling with the original team found the turn a kilometre up the road: a path that led into the King's forest. Original team members complained about the order, pointing out their success so far in finding a way out of the Kingdom; also the team had travelled beyond the King's factories in the west, and the air was now much more clear. The turn towards the forest was only a narrow path, hardly a road leading out of the Kingdom. Using runners, the turn in direction was confirmed by the the growing bureaucracy of managers, directors, and consultants at the Cathedral involved in The Quest, thus "making the voices of the Seconded Associates somewhat more quiet" (Interview with a Seconded Associate with Alberta Education, October 21, 1991) in future discussions about the direction of The Quest.

Silence

As we turned to enter the forest we paused to look one last time at the mountains, now clearly in view at the horizon of the Kingdom. Some of the original team members shared my concern the path we were on would lead us right back to the centre of the Kingdom, although with our new companions everyone felt uneasy questioning the wisdom of the Cathedral. A few of the original members of the team quietly asked one of the runners to deliver a letter to some Scholars. This letter informed the Scholars of the situation and asked for support in helping the team return to the previous route. The team members were convinced these Scholars would help since "they have some knowledge that is unique to their line of work that the teaching force and general public could benefit from" (Interview with a Seconded Associate with Alberta Education, October 10, 1991).

The Scholars considered the maps and communications from the team, and sent a message stating the sentiment that they felt "it would not be appropriate" (Interview with a Seconded Associate with Alberta Education, October 10, 1991) to defend the original direction of the team at this time. At the camp fire that evening I could feel the disappointment of the team. As we commiserated, one team member hypothesized that perhaps the Scholars did not want to seem to side against the Servanthood now that The Quest was beginning to develop a poor public image (Interview with a Seconded Associate, October 10, 1991). But it was more than this. In a later communication, a Scholar explained that among their kind "there was a lot of concern" the map produced during The Quest was "not as good as it could be or should be" (Interview with a Member of the University Community, May 29, 1992). The Scholars, while generally in favour of the idea of The Quest had definite reservations about the way the journey was headed.

The following morning the pathway led us deeper into the forest. Previous to this turn the mountains had been visible, but now we were surrounded by a seemingly endless sea of trees. Each tree carried a small sign indicating its fate; Servants had been here before us. The day was beautiful and warm and I cheerfully began a conversation with Foucault as we joined the others in The Quest. I asked him why the Scholars seemed to be unwilling to help us in The Quest. To this question Foucault characteristically asked another: Could silence be "part of the strategies that underlie and permeate discourse?" (Foucault, 1976/1990, p. 27). I was not sure, so I asked my companion if silence could be considered another form of speaking. Before he could respond to this idea, a messenger arrived.

It was bad news. The military had announced in every part of the Kingdom that an influential group of Servants had just withdrawn their support of The Quest. I thought this inconsequential since it seemed to me this support was never there in the first place, but other team members were devastated. Even worse, in a scathing public announcement, these Servants even went so far as to publicly question the wisdom of the Cathedral executive to initiate The Quest in the first place. At this point it certainly seemed that the Cathedral was "clearly losing the public relations battle" (Interview with a Career Associate with Alberta Education, October 29, 1991).

The messenger gave me a note. A Scholar had written to me explaining the rejection of The Quest by these Servants represented a "very powerful signal" to the Cathedral that the Servanthood, and some of the Scholars, "did not like what was going on" (Interview with a Member of the University Community, May 29, 1992). I shared the note with Foucault. Certainly the silence of the community of Scholars at this critical time in The Quest supported the notice of rejection by the Servants. The effect of this silence to give support to a shift in the hierarchy of authority for The Quest away from the Cathedral towards the Servants in the Kingdom. Military assistance helped legitimate this new hierarchical arrangement with the general public. I looked at Foucault, smiled, and said, "There are many ways to speak, are there not? Perhaps silence is one of them." He nodded, but then turned to me and asked why, if I was so concerned about the change in direction of The Quest, I did not return with the messenger and complain to the Military about the actions of the Servants.

Me? The question was unkind! I mean, I believed in the The Quest as much as anyone in the team, but I was only along to help prepare maps, to observe how The Quest was going and to record this story. At any rate, why would the Military listen to me, a mere apprentice to Scholarship? I turned to Foucault and asked, "Why me?" He replied that even an apprentice Scholar "can operate and struggle at the general level of that régime of truth which is so essential to the structure and functioning of our society" (Foucault, 1977/1980, p. 132). I had no idea what he meant and was offended by the answer. Later I wrote in my journal that my conversations with Foucault are causing "a lot of conflict" (Journal entry, April 2, 1991) as I was beginning to realize that I too am "part of the apparatus" of silence (same entry). For the first time in my journey, I regretted bringing Foucault along. It would not be the last.

Active marginalization

Everyone on The Quest knew there would be challenges, but we were not prepared for how our days in the forest seemed to stretch out until every hour felt like a day and every minute an hour. Still we travelled on. Days passed, relieved only by the occasional representative from the map-making company. Even these interruptions proved to be more a source of irritation as the maps shown us were increasingly vague. Even worse, delays in the arrival of maps forced the company to stop and camp, sometimes for days, before proceeding. A constant light drizzle and cloudy skies only added to our ill humour.

When a representative came wondering if we had any ideas on how future maps should look, some team members vented their frustration, accusing the company of not caring about The Quest at all. The representative acknowledged the business interests of the company, but added that once involved everyone in the company had come to believe in The Quest for the sake of "the teachers, and for the kids" (Interview with a Member of the Publishing Community, April 29, 1992). It was odd, but during the increase of criticism and hardship during The Quest team members and I had forgotten the original reason we left on The Quest. We began concerned about children in the Kingdom, but events had destined us to think more about the concerns of the Priest and Servants in the Kingdom until, as one team member put it, "the voices of students were completely pushed to the margins" (Interview with a Seconded Associate with Alberta Education, October 10, 1991).

Voices Without a Voice

Perhaps it was a return to thinking about the disappearing children that led me to begin to see and then hear phantoms in the forest. The next day I thought I saw someone, a child perhaps, standing in between the trees. When I turned to look again, the apparition was gone. All day long figures seemed to be just out of the range of actual vision. I tried looking straight ahead, but then suddenly I would catch-- what was it? There! Again, perhaps a glimpse, then the phantom disappeared. I was not frightened by these visions, but distracted. My colleagues, however, seemed to not notice these ghostly appearances at all.

We reached a small stream. It was a pleasant site, and the waters of the stream were cool, clear, and unpolluted- a rarity in the Kingdom these days. We all agreed this stream must be a tributary of the Great River which, travellers say, flows between the western and eastern arms of the Last Road encircling the Kingdom. We drank freely from the waters, and took a much needed rest. But I could not sleep. As I lay in the grass, I kept hearing the unmistakable sound of children speaking. I sat up, but all I could see were phantoms in the trees. I concentrated my whole being on listening. Then I heard gentle voices, speaking quietly but clearly and with accord, telling me that we should take the next path out of the forest. No one else seemed to be listening to these voices, although team members did comment on the haunting melodies of wind in the trees and the comforting sound of the water falling over the stones lining the stream. Perhaps that was all I was hearing. I turned to Foucault; he was listening intently. "What do you hear?" I asked. He replied that he heard the voices of those "excluded while being transmitted a knowledge traditional in nature, obsolete, 'academic' and not directly tied to the needs and problems of today" (Foucault, 1971/1989a, p. 65). "But they have something to tell us," I added, and I shared with Foucault how these voices shared with me a way to get out of the forest and back towards the mountains.

These voices without a voice, as I came to think of the phantom words in the forest, were correct in their prediction. After leaving the stream we came to a small junction. One path headed north while the path we were on curved just up ahead. I suggested that the north trail would be the path children might want us to take (Blades, 1992a, 1992b). But among the team the "concept that student voices might be an integral part of a curriculum-discourse never seemed to be considered" (Interview with a Member of the University Community, May 29, 1992). Unwilling to risk controversy again the majority of members elected to follow the directive from the Cathedral executive and not deviate from the trail they were on. I was told not to worry, since there must be many ways out of the Kingdom. I was not at all certain of this, but conceded the decision to move on might work out. We continued on our way, leaving behind the pathway north.

Personal Invasion

Very quickly the path in the forest widened and began to arc towards the south. I dreaded this movement, for according to my maps we were heading directly back towards the centre of the Kingdom. I did admit, though, to a feeling of relief as the sky cleared and the pathway became a small road. The team began to make excellent time, hiking with determination that soon the mountains would appear once again on the horizon.

The road ended abruptly at a large circular clearing in the forest. We knew from popular description we had arrived at King's Clearing. Here nearby villagers met for games, fellowship, and to discuss how to implement policies of the King. A welcoming place, to be sure, but we all knew the large highway at the opposite end of the Clearing led directly south to the Great Loop and on to the Central

City in the Kingdom. Clouds began to cover the sky and discouragement settled on the group as we slowly realized our journey in the forest had directed us away from our original objective.

To add to the grief of the team, messengers arrived almost every hour that day with updates on the controversy surrounding The Quest. Far from dying down, as we all had come to hope, resistance to The Quest was spreading throughout the Kingdom. Military commanders had worked with some of the Servanthood to spread the message that The Quest was somehow contributing to the problem of disappearing children! This latest gossip was disheartening to everyone connected with The Quest. That evening military commanders even began to send their own messengers to the team in the clearing. These newest messengers told of how the entire Cathedral organization was quickly losing support for The Quest. That night it began to rain.

The weather became worse the next day. Everyone became cold and wet, our misery heightened by constant and sometimes unbelievable messages about the controversy surrounding The Quest. We were shocked when the King's physicians and engineers publicly denounced The Quest. Dire warnings of bridges collapsing or widespread failure of health care in the Kingdom were predicted should The Quest continue. Citizens, understandably concerned if misinformed, became increasingly critical of the Cathedral organization, and the Chief Executive himself. There were even reports of the Military hanging throughout the Kingdom posters making fun of The Quest. It was if the entire Kingdom had turned against The Quest. Team leaders sent a message to the Cathedral asking for directions. The Chief Executive of the Cathedral sent word back that he had formed a committee with representatives from the many interest groups critical of The Quest. The purpose of this committee, claims the Chief Executive, "was to move critics into the zone of consultation" to "ensure the programs move ahead" (Interview with Mr. Dinning, May 15, 1992). Until this committee made its final recommendations concerning The Quest, we were told to simply stay where we were. The Cathedral sent us waterproof tents and told us to make camp.

Although hard to believe, a southerly wind began to accompany the rain, making it very difficult to even set up tents in the clearing. Team leaders ensured everyone else had a warm, dry tent to enter before finally working on their own tents. These leaders were becoming very soaked and I worried for their health. By some cruel twist of events, these leaders had also become the direct targets, often in a personal and pungent way, for criticism by Priests and citizens about The Quest. One of the team leaders shared with me how some messages involved "personal assaults on his professionalism" as a Priest (Interview with a Career Associate with Alberta Education, October 17, 1991). A team member later recalled how these messages "placed tremendous pressures" on this leader's family (Interview with a Seconded Associate with Alberta Education, October 17, 1991). Waiting in the Clearing during the intense criticism of The Quest was "an awful time" according to a team leader (same interview). This leader agreed with my observations that The Quest was now invading our personal lives, to the extent that criticisms challenged the "very essence of who we are and who we are becoming" (same interview). This personal invasion led to a type of "paralysis" (same interview) as the discourse about The Quest turned increasingly negative. It was if a force was pushing the voices of the team to the margins, while allowing other voices to dominate the agenda of The Quest. For the first time, members of the Quest, including the community of map-makers, began to have doubts The Quest would ever succeed. One member of the map-making community recalls during this time lying "awake at night," often from a sense of "burnt out" over the endeavour (Interview with a Member of the Publishing Community, April 29, 1992). But what did we expect, really? As this map-maker observed, all of us on The Quest were but a "handful of pioneers who were trying to change something by doing something new" (same interview). Perhaps the odds were against us from the start of The Quest.

The Voice of Critics

That night a message came that the Chief Executive's committee might save The Quest after all. The rain let up a little so we lit a bonfire and began to feel hopeful. Out of the dark came two figures towards our encampment, a Priest and a village doctor. We recognized the Priest immediately. He had been a leader of the group that first met us on the King's highway. The doctor we knew by reputation as a severe critic of The Quest and instrumental in raising public awareness and criticism of The Quest. Neither men were invited to sit by the fire.

The Priest went first. He had travelled from the southern city of the Kingdom to meet directly with the team on The Quest. He expressed concerns that the direction of The Quest was "flawed in several ways" (Interview with a Secondary School Science Teacher, April 29, 1992). According to the Priest's recollection of this meeting, team members were unwilling to "admit it's all wrong" because "people have made a reputation with the new programs" (same interview). I observed that everyone around the camp fire did not acknowledge the concerns of this Priest, choosing to ignore him totally. Yet the concerns this Priest shared that evening were not about The Quest itself, but the direction the team was travelling. For example, the Priest had examined the maps prepared for The Quest carefully and from his experience with children this Priest had come to believe one entire part of the map was completely useless. But the Priest was not invited to sit by the fire and discuss these concerns, but dismissed with a curt "we'll take this under advisement" by the team (same interview). The Priest left in disgust and I walked with him across the clearing. I asked him if he was all right. "I'm not argumentative at all," he told me, "this whole thing has taken a helluva [sic] toll out of me" (same interview). I was struck how even some of the voices critical of The Quest were seemingly pushed to the margins of our curriculum-discourse, this time by the team on The Quest. I asked the Priest if he intended to keep his concerns forthcoming. He turned to me and told me that, for the sake of the children he would continue to speak, for "it has to be done" (same interview). He left and vanished into the night.

The doctor was faring somewhat better. He had been invited to share his concerns, but by the time I returned to the camp fire I saw that in addition to team members and the doctor, a host of Military messengers were also gathered around the camp fire. These messengers were charged by their commanders to run back to cities and villages, reporting on the latest developments in the saga of The Quest. The doctor began the argument with a statement that the force of public and Non-Cathedral professional opinion was against the direction the present Quest had taken. A team leader suggested that had not these criticisms developed in the first place, the team probably would be in another Kingdom by now, ready to return with The Answer to the problem of disappearing children. The doctor countered the present maps of the quest are "illogically fragmented mishmash" (T. Byfield, 1989a, p. 44) that are useless in finding any way out of the Kingdom. He told us that without meaningful input from the Servanthood, any further attempt at a Quest is "fundamentally flawed" (Freedman, 1989a, p. 5). The team leader countered that The Quest is not designed to serve the Servanthood, but to solve the problem of disappearing children in the Kingdom. At any rate, only the Servants in the central city rejected The Quest, Servants in the southern city seemed to be generally supportive. In a reassuring voice, the leader reiterated that he and the entire team were committed to finding the best possible route to the next Kingdom. But the doctor voiced his doubt the Cathedral "even knows what that is" (Freedman, quoted in V. Byfield, 1989b, p. 44). This final comment sent messengers running throughout the kingdom and ended the argument; the doctor was ignored.

The doctor left that evening convinced more than ever his concerns were valid and important and I had the unmistakeable feeling we would hear more from this physician. What struck me about the conversation around the camp fire was how the team members and the doctor were not really arguing about the same thing. The team interpreted the doctor to be challenging the idea of the The Quest, when this doctor seemed to be voicing his concern for the direction of The Quest. Earlier in the argument the doctor had stated that, in his opinion, no one questioned having a Quest (Freedman, 1989a, p. 4), but there were valid criticisms about where this Quest was headed. A few years later, an executive in the Cathedral organization told me that it was unfortunate this doctor was "not responded to properly" (Interview with a Career Associate with Alberta Education, November 19, 1991). When I asked him what he meant, he replied that had the Cathedral "moved totally towards what he wanted we would be much farther ahead" in the goal of The Quest (same interview). This Associate recalls that while the doctor did present some rational and important points but because the doctor was cast as an antagonist to The Quest these points were ignored by the Cathedral. This was unfortunate, notes the executive, since the voice of this doctor could have provided a "a very strong support" for The Quest if given the chance (same interview). But again another voice of critique in the drama surrounding The Quest was pushed to the margins and eventually the ideas of this physician, some very legitimate, were left out of the discourse of that time.

The Strategy of Consultation

Weeks passed and the rains slowed somewhat, but even on the days when it was not raining the sky stayed cloudy. In hushed whispers between tents team members began to predict the end of The Quest. Then messengers came to me, sent by the map-making company. The Cathedral executive had decided to terminate my services as map-maker. I was deeply hurt, doubly because I would have preferred executives talk to me first. Now *my* voice was being marginalized and I did not like this one bit. Upon reflection, however, I realized this cancellation gave me the chance to resume my studies to become a Scholar. I wrote in my journal that the entire team seems to be fighting a force determined to prevent The Quest. I wondered about this force: "How can we fight it? Perhaps with critical reflection- something dormant in the lives of children and absent in the development of the new programs" (Journal entry, November 18, 1989).

A new year dawned, and with it the notice came that the team was to move out of the clearing. I was very happy for the team members, but the news was a mixed blessing. While The Quest out of the Kingdom would officially continue, the team was ordered to use only well marked, traditional routes. This meant leaving the Clearing by the south road. Still, heartened to be moving again, team members quickly broke camp and set out with renewed vigour. The team was resolute, determined to find a way out of the Kingdom even using traditional roadways. Walking briskly, the team was able to cover distance well and in a few hours came to a major crossroads in the Kingdom.

Signs indicated which way to travel. The road to the right, Village Way, was a well-used highway that led, presumably, to some village in the Kingdom. Straight ahead was a double lane highway that led due south to the famous Great Loop that ran around Great Lake at the centre of the Kingdom. The road to the left, with the odd name of Theme Way, was obviously little used. As the team considered their options, one team leader noticed a map lying by the signposts. Examining the map, the leader could not believe his good fortune. Written in some foreign script, the map suggested travelling the left road would take travellers eventually to the Mountains. The team decided to travel along this road.

Before venturing out, a strategy session was called. There was general agreement the announcement by the Chief Minister of the Cathedral the executive would reconsider the direction, but not the mandate, of The Quest gave the team the "clean slate" they needed to continue (Interview with a Seconded Associate with Alberta Education, October 10, 1991). To deal with any future resistance by the Priesthood, team members planned "quite a long period of consultation" (same interview) with Priests using questionnaires and meetings. In addition, team leaders decided to dispatch members of the team to every city, village, farm and factory to secure support of the public and Priests for this new turn in the direction of The Quest. Borrowing from tactics used by the Servanthood, the Military was asked to help support the new direction.

A month later the team reassembled a few kilometres down Theme Way. I was given permission to accompany the group as an apprentice Scholar. At the time I was not at all sure my studies related to the journey of the team, but I was quite glad to remain in contact with members of the team, many who had become personal friends. Foucault, now a constant companion during my time apprenticing for Scholarship, also accompanied me during this part of the journey.

I met up with the team and immediately asked how the consultative process fared. A team member shared with me it was a learning experience: "That taught me that a lot of people didn't bother, of those groups who said they were interested" (Interview with a Seconded Associate with Alberta Education, October 21, 1991). When groups so critical of the previous direction of The Quest were asked for advice, this member found that when given choice for possible directions, "of the many that did respond, mostly they wanted everything!" (same interview). The team member wondered, "so where does that leave you? Maybe the important thing is to provide the opportunity" (same interview). Another team member readily agreed with this assessment of the process of consultation.

Apparently the Priests this member of the team met were not able to give many constructive comments about the future direction of The Quest (Interview with a Seconded Associate with Alberta Education, October 10, 1991). While some Priests still remained suspicious about the intentions of the team members, every team member I spoke with felt that at least consultation had dealt effectively with potential resistance by the Priesthood, paving the way for The Quest to continue. A team leader explained that conflict during the early part of The Quest caused "an unwinding" that led to "complete loss of control" of the journey by Cathedral executives (Interview with a Career Associate with Alberta Education, October 17, 1991). The leader explained that the team decided to change tactics, giving the appearance of listening to the voices of the Priests so that the Quest could continue without interruption (same interview). I added that "in this way control is retained through collaboration" (same interview). The leader agreed, but noted that initially consultation was designed to find "a vision everyone could buy into" (same interview). This leader discovered though, like other team members, that when asked the Priesthood proposed every possible direction for The Quest. This lack of clear direction from the Priests led the team leaders to believe the Cathedral team had essentially a "carte blanche to make the decisions" on which direction to continue The Quest (same interview).

As my interviews continued it became increasingly clear that the team had been sincerely interested in the opinion of the Priests and Servants, but also that consultation was used as a strategy of political manoeuvring to affirm a direction for the Quest already chosen by the the Cathedral executive and Quest team leadership (Interview with a Secondary School Science Teacher, April 27, 1992). "As a procedure of power," a Servant told me later, "a ritual of compromise" was used to make the Cathedral organization "look good" while ensuring the accepted direction is "what they wanted all along" (same interview). While an organized conspiracy did not seem to exist, at least on a conscious level, nevertheless consultation ensured The Quest would proceed under the control of the Cathedral. Thus, the hierarchy of authority for The Quest shifted back to the Cathedral through consultation. But not entirely. Ironically, consultation also opened the possibility for a conservative response. The Chief Minister of the Cathedral expressed his concern that consultation also allowed conservative critics to demand the team take more traditional routes on The Quest, possibly frustrating efforts to find a way out of the Kingdom (Interview with Mr. Dinning, May 15, 1992). Consultation also proved costly. One executive in the Cathedral organization recalls that during the consultation period "we were desperately concerned about the delay" (Interview with a Career Associate with Alberta Education, October 29, 1991) since children were still disappearing at an alarming rate.

Foucault had listened in while I completed my interviews. As we walked with the team down Theme Way on this newest turn in The Quest I asked Foucault if consultation and marginalization might be procedures used by the Cathedral to regain power over the direction of The Quest. Foucault reminded me that power is not to be "taken as a right, which one is able to possess like a commodity, and which one can in consequence transfer or alienate" (Foucault, 1977/1980, p. 88).

"So you do not hold a Marxist view of power as commodity?" I asked.

Foucault shook his head and then tried to turn our conversation to the post-modern with his reply that when thinking about power we must avoid any "theoretical coronation of the whole" (p. 88).

But I was not convinced to abandon a theory of power yet. "Well, then perhaps power," I proposed, "is more like a battle for control, a type of warfare by one organization over another." But if this were so then how would you explain bureaucratization of an organization during the battle for control, I wondered.

The procedure of bureaucratization was a problem in understanding power as a struggle for control but what about the active marginalization of those critical of The Quest? Then Foucault reminded me that students, although not actively critical of The Quest, were still marginal to the discourse of The Quest. He reminded me that some of the people I interviewed expressed the opinion that had the organization listened instead of marginalized voices antagonistic to the original direction of the Quest, we all might be travelling in the mountains, or beyond, by now. Foucault (1976/1990) explained that while "there is no power that is exercised without a series of aims and objectives" this does not mean that power "results from the choice or decision of an individual subject" (p. 95). Foucault explained that when trying to understand power we should

> not look for the headquarters that presides over its rationality; neither the caste which governs, nor the groups which control the state apparatus, nor those who make the most important economic decisions. (p. 95)

"But," I argued, "if our understanding of power does not begin with questions about how power is held or which groups rule over power, what might we ask about how power operates?" Foucault smiled. I was thinking about The Quest when Foucault asked me:

> What were the most immediate, the most local power relations at work? How did they make possible these kinds of discourses, and conversely, how were these discourses used to support power relations? How was the action of these power relations modified by their very exercises, entailing a strengthening of some terms and a weakening of others, with effects of resistance and counterinvestments, so that there has never existed one type of subjugation, given once for all? (p. 97)

I made some comment that this viewpoint was little help if the term power relations was not defined. But Foucault was not going to allow our conversation to end.

He explained that these force relations are the "immediate effects of the divisions, inequalities, and disequilibriums which occur" in discourse-practices (Foucault, 1976/1990, p. 94).

"So," I cautiously summarized," then power acts through procedures..."

"Strategies," interrupted Foucault (p. 92).

"Or Strategies," I continued, irritated at the interruption, "and these procedures are not power but effects of power. So, then what *is* power?"

I thought he was simply avoiding the question when he responded that there exists one further question to always ask about power: "How were these power relations linked to one another according to the logic of a great strategy?" (p. 97)

"Some strategy!" I declared. "The Servants did not stop The Quest and the Cathedral executive has the Quest going in a different direction!" Foucault reminded me the journey was not yet over, and our conversation ended as we walked in the quiet of contemplation that seems to accompany a beautiful road on a warm afternoon just before sunset.

Destining What Can be Said in a Curriculum-Discourse

The team made excellent time on Theme Way and hope was restored that The Quest would reach a new kingdom soon. No doubt their good progress was due to the excellent weather during this part of the trip. Aside from the occasional shower and cool night, migrating birds and warm days announced the arrival of spring. Travelling success was also due to the excellent maps the map-making company was able to prepare now that the Cathedral had finally decided which way the team would travel. I was contacted by the map-makers to act as map interpreter for this part of the journey and I happily agreed to be once again involved in The Quest. I note in my journal that "things seem more contented, secure, able" (Journal entry, July 23, 1990) at this point.

Production of Knowledge

They were destined to remain so. The road we were on was heading due east and this direction, so the legends say, should take us to the Last Road of the Kingdom. Unfortunately, the maps used by the team at this time did not indicate how the road we were on links up to the Last Road, but everyone was confident that soon a direct route out of the kingdom lay just ahead.

Past a small junction that led south to a village, traffic became heavy. It was odd, really, how citizens who had earlier condemned The Quest now greeted us and spoke of their support for this new direction the team had taken. Even the members of the Military we met on the road greeted us, everyone claiming to be a fan of the chief Minister. We all noticed the difference in the mood of the Kingdom, wondering at the change.

Most of the team members thought the change in attitude was due to the newest production of documents to support his part of The Quest. Certainly the map-making company believed they played a decisive role in the recent acceptance of the team's new direction. Indicating exactly the road ahead, the newest maps indicated traditional routes that led the team away from the centre of the kingdom. I had asked a representative from the map-making company why the newest maps seemed to be helping. This particular representative recalls that during the earlier controversy team members "were not sure what they wanted" in a map, supposing only that they would "know it when they saw it" (Interview with a Member of the Publishing Community, April 29, 1992). This inability to articulate what kind of map the team wanted led, according to the map-maker, to an "endless loop" of drafts and revisions to the original map (same interview). After the Chief Minister's Committee declared The Quest would continue, but along more traditional routes, the map-makers decided they would "take a more active role" (same interview) in the production of maps for the the journey. By being more aggressive, map-makers found they "were able to change the curriculum" (same interview) of the Quest, shifting authority for the direction of the team towards the map-makers. This shift was demonstrated by the willingness of the Cathedral organization to even "change the Program of Studies" of The Quest so that it "goes with the text" of the maps (same interview).

Team members, however, held a different perception of reasons for the acceptance of the current direction of The Quest. I mentioned to a team leader that an executive with the Cathedral shared with me how the decision to travel Theme Way out of the Kingdom enabled the Servants, the most outspoken of critics, to see the "bigger issues" surrounding The Quest (Interview with a Career Associate with Alberta Education, April 24, 1992). According to this executive, these Servants, at least the ones located in the central city of the Kingdom, were more interested in saving children for the Servanthood than finding a cure for all the children in the Kingdom (same interview). This "fundamentally different perception about the nature" of The Quest between the Cathedral and Servanthood was part of the reason the Servanthood attacked the original direction of The Quest. The team member agreed with this assessment by the executive, noting that the decision to travel along Theme Way "helped to make the program more solid by recovering the respected solid ground" (Interview with a Seconded Associate with Alberta Education, October 21, 1991) of travel in the Kingdom. A different team member added that finding this sold ground meant adopting more traditional routes of travel in the Kingdom than the original route the team had taken (Interview with a Seconded Associate with Alberta Education, October 21, 1991). I asked my travelling companions if the inclusion of these traditional routes represented appeasement of the demands for tradition made by the Servanthood. A team leader jumped into the conversation at this point, enthusiastically describing the choice of roads as an "anchor" which "captured the spirit" of The Quest (Interview with a Career Associate with Alberta Education, October 17, 1991). But what did this mean? No one answered, so I continued to walk with them in silence.

Later that evening Foucault and I made one of our frequent trips back to the central city via the many roads heading south from Theme Way. While there I asked an executive with the Cathedral how they had come to view this latest route of the team. The executive bluntly described the new direction of the team as "the approach we had to take" to enable the Quest to continue (Interview with a Career Associate with Alberta Education, November 19, 1991).

"Then," I inquired, "does this mean the journey along Theme Way is more submission to tradition and less an effort to find a way out of the Kingdom?"

The executive thought for a moment and replied the decision to use more traditional roads was "a strategy" to find "the path of least resistance" for The Quest (same interview). I asked if the map-makers were thus forced to choose only the most traditional routes when preparing their maps for the team. The executive replied, "Absolutely, but it was directed to them [the map-makers] that way by us" (same interview).

Travelling north to rejoin the team, I thought about the decision to use Theme Way. Had the team chosen the road to the Village after leaving King's Clearing, possibly they would have found the King's highway once again and perhaps a more direct way out of the Kingdom. No one I met knew with certainty where Theme Way led. It seemed to me that while team members truly believed the decision to travel Theme Way was made by the Cathedral organization, now in control of the Quest once again, the desire to not rile the Servanthood any further played a major role in the decision to take this route. What was going on? I put the question to my travelling companion Foucault.

In characteristic fashion, Foucault asked me a question about how the decision to embark on Theme Way became public. I told him that documents, specifically a vision statement and program by the Cathedral organization were given to as many Priests and Servants in the Kingdom as possible. Foucault reminded me that maps are also documents produced to support the new direction of the team on The Quest. Foucault then asked me *how* these documents were produced. To this rhetorical question, Foucault provided an answer: Through "a regular manner by a discursive practice" (Foucault, 1969/1972, p. 182). He then explained that this production of documents is an expression of knowledge (savoir) in a discourse.

"By knowledge," I inquired, "do you mean the knowledge of something, like how to make a map or choose a road?"

Foucault shook his head. He replied that knowledge is "that of which one can speak in a discursive practice" (Foucault, 1969/1972, p. 182).

"So, then the choice of roads was in some way defined by the knowledge of which way to travel in The Quest..." I mused out loud. I recorded in my journal at this time that an idea, "so tenuous" began to form from my conversations with Foucault. I turned to Foucault, with the dawning realization of what my companion was suggesting. "Do you mean we are trapped in some kind of system that produces what may be known by what may be said?" It seemed incredible.

Foucault responded with an example, again avoiding a direct answer to my question. He began by asking why I left the team briefly for a visit to the central city. My journal of that visit notes I was "preparing for the thinking skills workshop" I was asked by the Cathedral executive to give to Priests due to be involved in implementing the recommendations of the team upon successful completion of The Quest (Journal entry, April 12, 1991). Foucault asked how the planning for the workshop went. I told him that I had developed a "linear, focused, and practical 'how to' session on developing thinking skills" (same entry). Foucault wondered out loud how this presentation promoted thinking. "In the participants?" I asked, but I could see his point. I had planned a session on thinking that, ironically, was thoughtless! Yet I believed in the importance of developing thoughtful thinking. I note in my journal, "I'm playing to a frame here, [I'm] a willing agent of the very forces I'm fighting!!!" (same entry). Indeed, Foucault suggested I had fallen into the entrapment of thinking about thinking in a technical way, not with any sense of critique. Even more to the point earlier, however, was Foucault's observation that my planning is exactly what one would expect. He asked me what materials I used in preparing the workshop. I admitted all my materials were from books on thinking that presented a very technical view of thinking. Foucault then drove the point home that this knowledge would not have existed without the technicality that permeates the discourse of the Priesthood. I saw his point, concluding that "the framing of technical approaches is seductive- even more as I contribute to it" (same entry). On the remainder of our trip back to the team I thought of how else I might organize the workshop to help the team really begin to think about thinking in non-technical ways. It was very, very difficult. I note later that, "Foucault is right, to really think, now *that's* work" (Same entry, later in the day. Emphasis in the journal entry).

Foucault's view "there is no knowledge without a particular discursive practice and any discursive practice may be defined by the knowledge that it forms" (Foucault, 1969/1972, p. 183) became more clear to me when I returned to join my friends on Theme Way. As we walked I asked if they though knowledge had a territorial effect, defining the direction of The Quest. Every team member agreed this was the case, at least with The Quest. They told me that during the early planning for The Quest a decision was made by The Cathedral executive to reduce funds, which are represented by credits in our Kingdom, for The Quest so that more credits could be used to strengthen other initiatives that might also help prevent the disappearance of children. But, the team member told me, Priests invested in The Quest "used their influence" to declare this shift in credits by the Cathedral a "watering down" of The Quest (interview with a Seconded Associate with Alberta Education, October 21, 1991). This credit crunch, as it came to be known in the Cathedral, led to an increase of Servants, Priests, other professionals, and the public into the controversy which, the team member reminded me, "changed things considerably" (same interview). Another team member explained the perception that developed among the Servants and public at this time was that the "real" Quest was being "taken over" or "punished" by this credit crunch, leading to the conclusion by some Servants and Priests the entire Quest was "watered down" (Interview with a Seconded Associate with Alberta Education, October 10, 1991).

A team leader suggested the "credit crunch" came to define what was important in the Kingdom (Interview with a Career Associate with Alberta Education, April 24, 1992). The dominance of issues surrounding the "credit crunch" was noticeable throughout the entire kingdom; interest in other ways to help prevent children from disappearing waned as controversy over the financing of The Quest dominated public discourse. I turned to Foucault. "So," I observed, "funding came to dominate the discourse and this led to..." A team member jumped into the conversation, informing me that already at King's Clearing everyone on the team knew that in order for The Quest to continue, credits for The Quest would have to be restored. When this happened with the announcement by the Chief Executive of the Cathedral, the team realized they would now have "more freedom to develop" the direction of The Quest "in line with our vision" (Interview with a Seconded Associate with Alberta Education, October 21, 1991).

"But," I pointed out to the team member, "this vision included a 'partial return to orthodox'" ways of travel (same interview) and less credits for other, potentially important ways to solve the riddle of disappearing children. I glanced at the horizon, so far away, and remembered an executive in the Cathedral organization predicted the restoration of credits to The Quest would be the beginning of a "reneging" of the original vision of The Quest (Interview with a Career Associate with Alberta Education, November 19, 1991). As I turned back towards the team I caught a glance from Foucault. Later that night I wrote in my journal that "patterns are emerging" about The Quest (Journal entry, May 14, 1991), but what these patterns suggested I found very disturbing.

Production of Truth

After several more days of travel along the scenic Theme Way the road suddenly split into two roads. Each of the new roads at the intersection was still called Theme Way, separated only by the addition of the direction the branches led. Judging by the wear in the roadway, Southwest Theme Way led back towards the centre of the kingdom. We decided to take the Northeast fork.

Litter along the road confirmed the King's engineers had not visited this branch of the Kingdom's roads for some time. This was strangely reassuring and we travelled in renewed hopes that soon we would find the Last Road and a subsequent way out of the Kingdom. A day later our expectations were not disappointed as the very peaks of the Lonely mountains appeared once again above large hills on the horizon. A sense of joy pervaded the team and everyone, well I can't vouch for Foucault, but everyone else began to feel success for The Quest was in reach.

Our happiness was spoiled by the disgusting litter left by those who went before us. This litter also contained a selection of highly sarcastic posters from the time controversy surrounded The Quest.[1] Although faded, the posters dampened the mood of the team as they recalled the seemingly endless days in the Forest and then the Clearing. A team member stopped to pick up some of the posters; we gathered around. I spoke first, telling team members the Chief Cathedral Executive told me once that posters depicting The Quest as "Mickey Mouse" or "watered down" had "undermined the credibility" of the original Quest (Interview with Jim Dinning, May 15, 1992). The Chief Executive explained that these criticisms were amplified through military campaign, with the assistance of Servants and critics from the Priesthood to the point of becoming truths about The Quest among the general public. The problem with the production of these public truths about the Quest, claims the Chief Executive, is that they became so overbearing that "had we gone ahead and tried to push the programs through the fighting might have placed the entire initiative in jeopardy" (same interview, also Interview with a Career Associate with Alberta Education, April 24, 1992).

Team members agreed with this assessment by the Chief Executive of the Cathedral. Someone shared how the word rigour came to haunt people involved in planning and travelling The Quest. To Servants, a rigourous Quest follows strictly defined roadways along traditional routes. The team member explained that this approach has yet to find a way out of the Kingdom. The Cathedral executive supported a more open choosing of pathways as The Quest progressed, what they termed well-rounded routes for The Quest (interview with a Career Associate with Alberta Education, October 17, 1991). But this approach soon was labelled as lacking in rigour by Servants of the central city in the Kingdom. Since Servants seem to hold more esteem in the public eye, the portrayal of the routes taken by the team on The Quest as less rigourous soon produced the public truth that the Cathedral was somehow diluting The Quest. Combined with the belief that credit cuts undermined an already weakened Quest, a sort of public panic emerged. It was all quite depressing, since these public truths seem to arise from mis-communication and mis-perceptions about The Quest (Interview with a Career Associate with Alberta Education, April 24, 1992). "For example," I chimed in, "the team *did* set out on a well-marked, clear, *rigourous* road- one of the most frequented roadways in the Kingdom." I wanted to add that a representative from the map-making company felt the *present* direction of the team along theme Way was more compromise that rigour (Interview with a Member of the Publishing Community, April 29, 1991), but I decided against it .

---

[1] Storytellers note: See Chapter 2, p. 70 for an example of the type of posters produced at this time. In the allegory, posters broadly refers to newspaper headlines, cartoons, and covers of magazines.

Public truths surrounding The Quest even permeated the Cathedral organization. Team members noted with some distaste how some members of the organization suggested restoring the original credit support for The Quest would "power up" The Quest (Interview with a Seconded Associate with Alberta Education, October 17, 1991). According to one team leader, the desire of the Cathedral executive to make the choice of routes appear more rigourous to critics led the Cathedral organization to order the team to turn off the road and into the forest (same interview). This invasion into the ranks of those who believed in The Quest the most demonstrates how effective a public truth can be in defining what can be said in a discourse. A team member told me that during the controversy some members of the Servanthood were invited to look over the maps team members were developing. This team member told me that once a public truth is in place, however, *"it defines what people see and say"* (Interview with a Seconded Associate, October 10, 1991, emphasis mine). The member experienced this first hand as the Servant handed back the map with the comment that the team was not considering the roads ahead. Yet the next page of the map *did* indicate the roads ahead, the Servant simply missed it somehow. The Servant subsequently informed the military that the Cathedral team does not even have maps indicating where they were headed, supporting the public truth The Quest lacked rigourous planning. Foucault then mentioned quietly that this demonstrates how truths in a discourse, far from being outside power, are more a "regular effects of power" (Foucault, 1984b, p. 73). I turned to him as he explained that

> each society has its regimes of truth, its "general politics" of truth: that is, the types of discourse which it accepts and makes function as true; the mechanisms and instances which enable each one to distinguish true and false statements, the means by which each is sanctioned; the techniques and procedures accorded value in the acquisition of truth; the status of those who are charged with saying what counts as true. (p. 73)

"So why," I asked, "given the prestige of Servants in the Kingdom were we so surprised the Servants had the most power in producing truth in the debates over the direction of The Quest?"

Foucault could hardly hide his disappointment. He said gently, "truth *is* already power" (p. 75, emphasis mine). I thought about this for a long time. Later that night I couldn't sleep. I record in my journal that what Foucault said that day "hit a raw nerve with me" (Journal entry, October 23, 1991). In the same entry I observe that if truth is power, then discourse must be "regulated by rituals demonstrated by exclusion and definitions" (same entry). Suddenly I understood what Foucault meant by power, knowledge and truth: a discursive, dynamic system that "defines what I can say and be, and in turn which I define and defend" (Journal entry, October 25, 1991). So, I'm a willing and active prisoner in some sort of giant discourse? This was a profoundly unpleasant thought and once again I wished I hadn't brought Foucault with me! Life was so much easier before my conversations with him! But I was destined to realize the importance of Foucault's insights in the days ahead.

Characteristics of Power in a Curriculum-Discourse

> In the end, we are judged, condemned, classified, determined in our undertakings, destined to a certain mode of living or dying, as a function of the true discourses which are the bearers of the specific effects of power.
> Foucault (1977/1980), Power/Knowledge, p. 94.

Only three days after my last journey entry the team reached an unusual bend in the Northeastern branch of Trail Way. The road seemed to make a giant curve to the right, apparently heading due south alongside the great hills now obscuring our view of the eastern arms of the Lonely Mountains. Branching off this bend in the road was a narrow dirt path leading directly into the hills. We decided to break for lunch before deciding which direction to take. The lovely warmth of the midday sun and excellent food conspired with the weariness that comes from many days of travel; soon everyone was fast asleep.

A noise along the road behind us woke me. Everyone else was sleeping, including Foucault. I was glad to see him sleeping, for his intense nature (Eribon, 1991, Miller, 1993) had worn him completely out and lately I worried for his health. The noise behind us was a messenger, dressed in official clothes of the Cathedral. I walked up to him as quietly as possible, gesturing for silence all the while so everyone else could continue to enjoy a much needed rest. The messenger understood, and handed me a note.

It was for me. Someone in the Cathedral executive was ill and I was offered the opportunity to formally join the organization. Excellent benefits and security accompanied the offer. I would have to delay or abandon my Scholarly studies, of course, and, if interested, should report to the Cathedral in the central city immediately. A friend in the Cathedral organization had signed the offer, so I knew it was genuine.

I lay in the warm grass and thought about life in the central city. An important role in the Cathedral organization... it *was* tempting. I recorded that offer was a "a real chance to make a difference" (Journal entry, October 28, 1991). Then I thought, "or was it? What freedom would I *really* have? Perhaps there *could* be an opportunity to make a difference- but ultimately what would the plan and action and policies *actually* be?" (same entry- emphasis in text). Suddenly, I was "struck by the reality of it all, the *apparatus* exists and the process is, to some extent, inevitable" (Journal entry, October 29, emphasis in the text). I looked over at Foucault, still sleeping. "Foucault makes a lot of sense now," I wrote in my journal, "but in his ideas something terrible emerges- something almost organic, alive, an ecology of discourse. It's creepy to see how powerful the system is and how it can suck people in" (same entry). Even though deeply honoured, I decided to say no to the offer to work for the Cathedral executive. As I laid back down in tall, cool grass I remember thinking that my conversations with Foucault are starting to be "all jars and shocks, leaving disquiet and discomfort in its wake. I no longer feel comfortable" (Journal entry, November 8, 1991). It took a long time to fall back asleep.

I woke up in the middle of the night to stars everywhere. As far as I could tell in the silvery moonlight, everyone was gone! I yelled out, and felt a wave of relief as I heard Foucault laugh. I could see him by the side of the road at the bend. "Where is everyone?" I asked. He wasn't sure himself, presumably the rest of the team had travelled down the main road and only just now were realizing we were still here. "Or perhaps they thought I had gone back to the city," I suggested. My companion admitted this also was a possibility. We decided to wait until morning, then travel further down the road to rejoin the others.

The Adaptability of Power

We had just cleared up from our morning meal when we heard the sound of a small group of people coming from the trail leading into the hills. The group was running and, after a few minutes, we could recognize the group as some of the team members and a Scholar. They met us excited and somewhat out of breath. They exclaimed that they had found a new route that promised to lead out of the Kingdom, pointing with enthusiasm to the narrow path off the road. I thought I heard someone say the path led directly to the Last Road when another team member wondered out loud where everyone had gone.

I did not know, surmising the team had stayed together. We all sat down while events of the evening were shared. Apparently, after I had just fallen asleep, a well known Scholar had dropped by and joined some of the team members who wanted to scout the trail. The group members shared how the trail provided an easy access through the hills, leading to the beginnings of a major highway. Every group member was certain this was the Last Road of the Kingdom, since beyond the road lay the unmistakable outline of the Lonely Mountains. The Scholar declared the side trip was "very stimulating" for the "number of ideas" the route presented (Interview with a Member of the University Community, May 29, 1992). This Scholar explained the pathway, while obviously little used, nevertheless presented a "modern, very contemporary" route. One of the group members immediately agreed the path seemed to travel in the direction the Team wished to go (Interview with a Seconded Associate with Alberta Education, April 27, 1992). Everyone I travelled with that day were most excited to finally discover a pathway that "re-captured the vision" (Interview with a Member of the University Community, May 29, 1992) of The Quest: Finding a cure to the problem of disappearing children by travelling outside the Kingdom. I still have a copy of the rough map this small group had made of their trip down the trail. Although sketchy, the map clearly indicates what could only be the beginnings of the The Last Road and thus, if the legends held true, a way out of the Kingdom.

The scouting group had expected the rest of the team would wait for their report; apparently they did not. We discussed the situation and came to the conclusion the rest of the team must have decided to continue along Northeastern Theme Way, probably camping only a short distance away from us. We decided to send a messenger to run ahead with the map so the rest of the team ahead could turn back and join us. Finally, our journey out of the Kingdom seemed at hand; soon we would be travelling the Last Road of the Kingdom!

Three days passed and still the messenger did not return. This delay led to an "increasing unease" (Interview with a Member of the University Community, May 29, 1992) as we were "not contacted at all" (same interview) about the map the group had made. The next day the group decided they had waited long enough and travelled down the road to find the missing messenger and the rest of the team. It was two full days later that the messenger returned to us. Apparently the rest of the team had travelled farther down Theme Way than we had expected. The messenger also handed us back the map we had sent.

Lines were scribbled all over the map, but the message was clear enough: "the basic structure of the course" sketched out had been revised "rather drastically" (Interview with a Member of the University Community, May 29, 1992) towards declaring Theme Way the *only* way out of the Kingdom. But with the discovery of a direct route to the Last Road, a return to travelling Theme Way seemed like the team was "still representing outdated material [and] outdated concepts" (same interview) for finding a way out of the Kingdom. Angered with this apparent set-back, the group travelled quickly down the road to re-join their colleagues.

It took another four days to eventually find the rest of the team. There was immediate understanding for the frustration felt by the group that had scouted the pathway through the hills. It took some time to piece together what had transpired over the days since the team had split up. Apparently the rest of the team had decided to travel only a few days down the road to see if the bend in the road continued to travel along the hills. After a few days they came to an intersection with a major road leading west. They camped that night at the intersection, receiving the map by the scouting group the following morning. As excited as we had been, this part of the team were just about to turn back when a messenger arrived along the west road. The Cathedral executive wanted a progress report and one of the team members thought it wise to give the new map to the messenger so the Cathedral executive might examine the intention of the team to change direction. The messenger returned from the Cathedral only a day later with the news that the change in direction was considered "unacceptable" (Interview with a Seconded Associate with Alberta Education, April 27, 1992). The team was instructed to "re-work" the map "to the satisfaction and specifications" (same interview; also Interview with a Seconded Associate with

Alberta Education, October 21, 1991) of the executive, that is, to re-consider a more traditional route that would be more in line with what people critical of The Quest might expect. The team felt they had no choice but to prepare a map that became "something very different" (Interview with a Seconded Associate with Alberta Education, April 27, 1992) from what the scouting party envisioned. One team member explained that when presented with the map, someone in the Cathedral organization had "reined in" the team from the "tangent" they had almost chosen (same interview).

We were so close to travelling beyond the hills. I was still angry over the last-minute intrusion by the Cathedral executive, but team members took the directive in stride, still confident the road they travelled would eventually lead out of the Kingdom. I did not share their optimism for two reasons. First, the messenger needed only two days to complete a round trip to the central city of the Kingdom, suggesting the team was closer to the centre of the Kingdom than they realized. And second, the map I was drafting of our journey indicated the team had really travelled in a giant circle, confirming my first point. It was as if every opportunity to move out of the Kingdom was thwarted by some event or well-meaning directive that forced the team back towards the centre of the Kingdom. This last incident demonstrated how effective this pull towards the centre was. Foucault agreed with my observation that there seemed to be an "omnipresence of power" (Foucault, 1976/1990, p. 94) at work, always pulling the team towards traditional routes. My companion told me that his research reveals that this power is "produced from one moment to the next, at every point, or rather in every relation from one point to another" (p. 93). He emphasized that this power is mobile and adaptable to situations, since power "comes from everywhere" (p. 93). It is "the overall effect that emerges from these mobilities" (p. 93) that Foucault calls power. In the case of The Quest, power operated through mobile procedures to effectively turn the team constantly back towards the centre of the Kingdom. I was beginning to believe this team was destined to never complete The Quest.

The Great Anonymous

But this was their destiny, not mine. I decided to travel back and seek out the Last Road along the pathway the scouts had discovered. I bid my comrades farewell, wishing them success with enthusiasm, but not much hope. I began with them as part of the team, saw members come and go, shared in their trials and invested in their hopes. But the time had come for me to travel along a different route. During the past two years I became convinced a route out of the Kingdom must exist, and together with Foucault I was determined to find it. I knew I would miss my friends from the Cathedral, but it was time to go.

I decided the path discovered earlier by some members of the group might offer the fastest way out of the hills and in only a few days Foucault and I reached the junction of Northeast Theme Way and the path leading into the hills. I found the path clearly marked and we made excellent time. In only a few hours we reached the summit of the trail where a commanding view of the plains below greeted us. I could see the trail did lead to what appeared to be the start of a major road heading northwest. Even more thrilling, we could make out the majestic peaks of the Lonely Mountains far in the distance. Encouraged by the view, we reached the end of this trail by nightfall.

The trail through the hills proved to be a pass that led directly to the start of a well constructed road. At this end of the road there was almost no sign travellers had been here before us, but the road was in excellent condition so presumably the King's engineers did frequent the area. We travelled the only way the road led, northwest towards the Mountains.

It is amazing how something in the distance seems closer than it really is, at least that is how the Mountains seemed to me. Days became weeks as we travelled, yet the mountains still seemed a considerable distance away. I know I was poor company, often walking for hours without speaking to Foucault. When I wondered out loud if taking this road was such a great idea, Foucault caught my attention with a statement that was to occupy our conversation for days. He simply stated that there was no King.

To this absurdity I immediately pointed out that in order for a Kingdom to exist, there has to be, by definition, a King. Foucault asked me why this had to be so, adding that just because a Kingdom existed and ran well does not at all require a King at all. I thought this was purely silly, and told Foucault so. But my companion was not so easily put off this topic; our conversation continued for many days. My argument for the existence of the King focused on the need for centralized control in the Kingdom. I presented my case carefully, suggesting the Kingdom would quickly fall into anarchy should there not be a King.

Foucault, of course, did not agree. He suggested the King could disappear, yet everyone was so used to acting as if there King existed that life in the Kingdom would simply continue as it always had. To make this point, Foucault asked me about the history of membership in the team that left on The Quest. I recalled a map-maker told me the constant migration of people into and out of team on The Quest made developing a map difficult. The map-maker thought some continuity in team personnel "would have helped" the role of map-makers in The Quest (Interview with a Member of the Publishing Community, May 29, 1992). A Scholar claimed the continual change in map-makers during The Quest delayed establishing the sense of community needed to produce a high quality, useful map (Interview with a Member of the University Community, May 29, 1992). Yet one executive with the Cathedral told me the changes in team membership proved to be "significant" in assisting The Quest to continue (Interview with a Career Associate with Alberta Education, October 29, 1991), especially during the controversy while the map-making company seemed to agree the newest set of map-makers they assembled were better able than previous map-makers to produce the maps needed for the team to continue. In each case, movement of people in and out of The Quest was seen as improvement in the personnel associated with The Quest. But this contradicts the view that continuity of personnel is important in a project the magnitude of The Quest. It didn't make sense and I couldn't see how this contradiction related to the existence of the King.

We came upon a stone bridge arched over a small stream. I had been so totally engrossed in my conversation with Foucault that I hadn't noticed the landscape change. To the north the Lonely Mountains were plainly visible, rising with majesty from the northern plains. The stream before us appeared to cross this plain, likely originating at the foot of some glacier in the mountains. At the bridge the stream split into two, one branch heading along the roadway, another turning sharply to head towards the forest we could see in the distance on our left. It was a beautiful, cloudless day and the bridge seemed almost magical with the sound of the water rushing beneath us. We paused in our journey to admire the view of the forest. I closed my eyes, basking in the peace of the moment.

I glanced ahead of us and saw for the first time a small trail leading to our road from the forest. A wave of shock came over me as I realized exactly where we were. The forest was none other than the King's Forest, and the stream the very one the team and I passed in the forest. The memory of the haunting sounds of the voices of children came to me as I saw the trail these voices told us did lead directly to the road I was now travelling. I looked at the direction ahead. There could be no doubt, the signs were unmistakable: legends spoke of a road beside a river at the outer reaches of the Kingdom, a road that would lead to a trail out of the Kingdom. Foucault and I had were travelling on the legendary Last Road.

I was anxious to continue travelling as quickly as possible, but my companion was not. Perhaps the sunshine was too warm or the bridge too idyllic, at any rate Foucault suggested we have lunch at this beautiful site before continuing. I reluctantly agreed. The memory of the voices of children seemed to affect Foucault as well. We talked about the Cathedral which Foucault described as part of the "highly complex systems of manipulation and conditioning" of the bodies of children (Foucault, 1977/1980, p. 125). These systems could only exist through "access to the bodies of individuals, to their acts, attitudes and modes of everyday behaviour" (p. 125). I agreed, but reminded Foucault it was hardly a great insight that the Cathedral controlled the lives of children. But Foucault was not at all finished. He asked me if I thought the Kingdom worked through "the productive service from individuals in their concrete lives" (p. 125). Again, I conceded this was the case. Foucault asked if I thought this service was the result of some oppressive force. I replied this was not likely, since most of the people I knew enjoyed their service to the King; being forced to serve would likely lead to revolution, I added. Foucault agreed with my sentiment; he continued on his line of reasoning by then asking *how* the service of the people in the Kingdom is coordinated. I surmised some type of surveillance system might exist, perhaps through the military, although I could not provide any evidence for such a system. Foucault continued to propose that with such a system one "must be able to simultaneously both to increase the subjected forces and to improve the force and efficacy of that which subjects them" (p. 104). "

But, I argued, "this means a King must exist!"

Unless this system involved "a tightly knit grid of material coercions rather than the physical existence of a sovereign" (p. 104), countered Foucault.

"Is this nexus of relations, concretely expressed in the lives of individuals, what you mean by "power?" I asked.

Foucault replied it is, adding that this type of power

> is in every aspect the antithesis of that mechanism of power which the theory of sovereignty described or sought to describe. The latter is linked to a form of power that is exercised over the Earth and its products, much more than over human bodies as their operations... It enables power to be founded in the physical existence of the sovereign, but not in continuous and permanent systems of surveillance. (pp. 104-105)

And these systems of surveillance are possible, Foucault suggested, through "procedures which allowed the effects of power to circulate in a manner at once continuous, uninterrupted, adapted and 'individualised' throughout the entire social body" (p. 119).

Unnerved, I replied, "Are you suggesting, Foucault, that instead of power located with the King, that power is now expressed in the day to day lives of the citizens of the Kingdom?" I thought of The Quest and turned white. "Then," I continued with dawning realization, "it did not matter *who* migrated in and out of The Quest, procedures of power were at force to prevent the team from ever leaving the Kingdom." And if this was the case, you would expect interpretations of the effects of movement of people in and out of The Quest to be contradictory since the lack of success of the team would be blamed on either lack of continuity of personnel or not enough changes in personnel when necessary. Either way, though, it did not matter to the final result. As I pondered these things, I felt as if some idea, some important insight was just out of reach. Later that evening I wrote in my Journal that "I feel as a small child, groping for a light switch in a dark, unfamiliar room" (Journal entry, November 10, 1991).

The following day we made excellent time, travelling now due west along the Last Road. The road was mostly deserted, the few travellers we did meet were Scholars and Scholars-in-Training. Still troubled by Foucault's ideas of power, I wondered aloud that in the final analysis if Foucault might not be criticized for "seeing power everywhere, and, in the final analysis, of reducing everything to power?" (Foucault, 1978/1988, p. 104). Foucault did admit that this was "an important question" (p. 104). While he "refrained from seeing power everywhere," (p. 105) he confessed that one of his research interests was in how discovering how the "procedures for training and exercising power over individuals" was "extended, generalized, and improved" (p. 105) from the eighteenth century onwards. These procedures, Foucault explained, are "often quite explicit at the restricted level where they are inscribed" (Foucault, 1976/1990, p. 95). He reviewed the procedures we had encountered with the team: bureaucratization, silence, marginalization, consultation, and the production of knowledge and truth. While the logic of these procedures may be perfectly clear, "it is often the case that no one is there to have invented them: an implicit characteristic of the great anonymous" (p. 95).

"Thus the reason you believe there is no King, right?" I added. He smiled, relieved I think to see I was beginning to understood what he was saying. I continued, "If these procedures of power are adaptable and anonymous, then all of us are part of these systems of power, including you, Foucault."

My companion agreed, recognizing that in the trachealization of procedures of power "the disease he seeks to cure is part of an epidemic which has also affected him" (Dreyfus & Rabinow, 1983, p. 202).

"You make it seem as if the systems of power operating in the Kingdom are some kind of disease!" I responded. I laughed at the thought, but Foucault did not.

Effecting an End to The Quest

The next part of our journey was rather uneventful and, except for the rare traveller, the Last Road proved to be quite abandoned. The stream beside us became a small river and while the waters were clean and swift, after days of travel I longed for a change in scenery. We travelled beside the Lonely Mountains now and my discouragement grew with every kilometre we travelled.

Then the wind shifted towards the north and a foul stench covered the air. The smell was familiar, but I could not place it for some time. Foucault had the same feeling. After a few hours we realized we were smelling the factories of the western regions of the Kingdom, the same odour that greeted us when we had travelled with the original team on The quest along the left fork of the King's Highway. Foucault was considerably cheered by this sign, but I sunk even lower into depression. It seemed to me that all we had accomplished is a giant loop back towards a major road that leads directly towards the centre of the Kingdom. Just as I began to truly despair of my whole adventure, we came to a suspension bridge over the river.

It was Foucault's turn to be excited. He told me this we had arrived at the Valley of Bridges. The first bridge, explained Foucault, led to a trail that would take us directly north to a pass through the Lonely Mountains. But I was not as interested in going on any more. The long days and nights, gruelling conditions and distinct lack of success left me feeling "adrift and my compass gone" (Journal entry, November 15, 1991). I looked at Foucault. I felt my relationship with this companion had "changed me in profound ways" (same entry), but still I kept wondering, "What am I doing? Right now, it's hard to say" (same entry). I searched my heart at the foot of this bridge, and but I kept finding things I don't like-- insights I wish I'd never found" (Journal entry, November 22, 1991). And somehow I knew there would be more if I were to cross this bridge. I didn't have to go, of course. I could return to the central city in the Kingdom, resume my studies and forget everything. It was possible, I thought, all I had to do was turn left and take the path.

I suppose that was the first time I even noticed the path. It led directly from the south of the kingdom to the bridge, a perpendicular bisection of the Last Road. A thought occurred to me and I hastily climbed on the bridge for a better view of this trail. Facing south, I could just make out the massive factories of the western regions, their noxious fumes now blowing east. I followed the horizon left until I saw the direction the trail south seemed to be leading: in the distance I saw a thin pencil line that I knew, without a shadow of a doubt, was the King's Highway. If only the original team had not headed into the forest so long ago.

My depression turned to anger as I realized how close we had been. Then I thought about all the children that had disappeared since we first started out. The waste of it all grieved my spirit, the heartache of the controversy came back to me again and found myself missing my friends still hoping to find a way out of the Kingdom. I wished them well and wondered how they were faring. At this exact moment a messenger ran up the bridge, announcing there was a letter addressed to me. The letter, addressed weeks before, was delayed because the messenger service in the Kingdom had lost track of me for awhile. This seemed likely since message delivery was never very reliable under the best of circumstances in our Kingdom, and I gratefully accepted the letter. It was from one of the team members with the group travelling Northeast Theme Way:

Dear David,

We are sorry you left when you did, since the most exciting part of our journey was yet to come. We travelled for several days along Northeast Theme Way when the road simply stopped before a series of very large hills. A small trail called Pioneer Road led directly into the hills. Could there be any doubt this road was actually a pass out of the Kingdom? The trail (for that is what it was) was poorly marked and less used, but we made excellent time through the hills. After only two days we arrived at a large plain. The trail continued straight ahead directly towards the centre of the plain. The territory was completely new to us. We decided the best course of action was to continue along what we could find of Pioneer Road.

Excellent weather made our travel easy and in only a day our trail came to end at the shores of a large body of water. Some of our group felt this was indeed some part of a new Kingdom, but others were not certain. We made a base camp by the shore and sent scouting parties throughout the region.

One group reported seeing the glow of a great city or some evidence of industrialization from the southern regions of the inland sea. Another group found a small collection of huts built by people who called themselves pioneers. I was personally amazed these people could speak the same language as everyone in the team (something I worried about, remember?) and inquiries soon revealed that the children of these pioneers were not disappearing. Everyone is certain hope for finding a cure for our disappearing children exists with these people.

In the hope you find what you are looking for,

T.M.

I looked and behind the letter was another, more recent letter.

A few weeks later

David-

Odd news. Some of our team travelled the region from the southern part of the great sea to the glow, only to discover the light caused by the central city of our Kingdom! We now know we did not travel outside the Kingdom after all. I know how much you wanted to find a way out and believed that is where hope for our children might be found, but perhaps you are looking too far afield.

We have discovered an entire region of the Kingdom hitherto virtually unknown. The people here are happy, if poor, and seem oblivious to the benefits offered as citizens of the Kingdom. In many ways, the entire region is a completely underdeveloped wilderness. Even more exciting to us is the fact that the disappearance of children is unknown here. Perhaps some medicinal cure or mineral in the ground protects these children, we are not sure. The King's physicians will be here shortly to examine the children themselves and we expect engineers and Servants to follow. The pioneers here will surely be glad to have the health of their children and the development of the region entrusted to skilled experts.

While we did not find a way out of the Kingdom, everyone here is quite happy with what we have discovered. Executives from the Cathedral came to see us yesterday. An executive told us that we should be proud of what we accomplished, since "there are some things you can't do, there's a limit to acceptable change" (Interview with a Career Associate with Alberta Education, October 29, 1991). Another executive put it this way: "It may not be the kind of changes we would like, and it may not be as far along as we wanted to go, but something has happened" (Interview with a Career Associate with Alberta Education, April 24, 1992). We all sense our team has managed "a step" that will prove to be evolutionary in finding a cure to the problem of disappearing children (Interview with a Career Associate with Alberta Education, October 17, 1991). Now David, I realize the danger in a small amount of movement is that "you may not be getting anywhere" (Interview with a Seconded Associate with Alberta Education, October 21, 1991), but we are convinced that our Quest will not prove in vain. Like the Chief Executive of the Cathedral says, at least in our exploration of this new territory we can "see possibilities and then have the chance to try out new ideas" (Interview with Mr. Dinning, May 15, 1992). We think those possibilities are here and so our Quest is, after such a long (and sometimes painful!) journey, finally over.

All the best,

T.M.

I put the letters in the envelope and looked over the western horizon. The smoke that hangs over this region had lifted somewhat and I could see clearly the deforestation of the western hills, the great factories of the Kingdom and the shores of Long Lake, rumoured to be the most polluted waters in the land. To my right the bridge led to a pathway leading directly to the Lonely Mountains. I turned to Foucault and told him of the contents of the letter. "Do you realize where they are?" I asked rhetorically. "They travelled for over two years to end up almost directly in the centre of the kingdom!" I exclaimed in despair. Foucault nodded with understanding, but said nothing. "The Quest is over," I said with bitterness in my voice. "And somehow," I continued, "I know the cure for the disappearing children won't be found in the eastern regions of this Kingdom." I followed the path of the river below me, watching how its path turned in a great arc towards the industrial regions. Then an idea occurred to me. "If a King does not exist," I told Foucault, "then power is a system that preserves the status quo." He looked at me, but did not speak. Encouraged, I continued, "But must it always be so? Will power always pull us back to the centre?" I looked towards the Lonely Mountains, so beautiful and now so close. I did not know if the trip outside the Kingdom was possible, but I knew I had to try. I turned to Foucault and said with conviction, "Let's go."

Is Change in a Curriculum-Discourse Possible?

True enlightenment is to really know, really feel, your ontological dilemma.
Berman (1989), Coming to our Senses, p. 310.

The mountains were much closer that we could have guessed from the bridge and we crossed the northern plain quickly. The trees were blackened and in some cases dead from the pollution of the factories, spoiling our view but not our determination. Eventually the trail led to a series of small hills directly beneath the shadows of the Lonely Mountains. Then the trail began to lead at a sharp incline.

The mountain air was cool and refreshing, but I could hardly get enough as I struggled to breathe during the assent. The trail, fortunately, was well marked, but I could tell that my travels had not prepared me for the physical exertion required. We had to stop often. All around us was silent and I had the distinct impression the Mountains were watching us. The trail became nothing more than a series of cairns set every few hundred meters. A few times we missed these rocky markers and had to go back and try again. Finally the trail became more level as we hiked directly into the mountains. We caught our breath and, encouraged by more level territory, began to hike with great energy along a rocky ledge that seemed to be a pass through the mountain range. Foucault estimated that at our present speed we should be through the mountains before nightfall. Then it started to snow.

Snowfall is a present danger any time of the year in the mountains. Soon everything was white and our trail less obvious. We were in danger of losing our way totally when I caught the light of a mountain chalet. The temperature was falling and our choices very limited. We made our way to the chalet.

A warm welcome and meal awaited us. The family that owned the chalet were poor, but used to helping strangers in trouble in the mountains. They had anticipated someone might be dropping by and prepared a little extra of their Friday night meal. While we ate and exchanged news, two beautiful children shyly peeked in from another room. I asked about the children. Our hosts told us these were the last children in the mountains, all the others had slowly disappeared. I was amazed children were disappearing even in the margins of the Kingdom, but our hosts told us the plague was especially severe in these regions. I caught the peeking eye of one child, who returned my smile. They're both old enough to be studying at the Cathedral, I thought. I looked into the faces of our generous hosts. They were frightened for their children, but gravely concerned for all the children in the Kingdom. You could see the worry on their faces. I could not help but share the mission my companion and I had chosen. The family was greatly interested in our travels and troubles. When we finally came to the end of the tale, our hosts told us the route we had chosen would not take us to the other side of the mountains. They told us their children knew the way out and told us the children would lead us.

Thankfully the snow abated and in a few hours we left the warm of the chalet, led by the two children. I admit I was reluctant to leave the hospitality of the family, but my rest there gave me the courage to continue. Our guides were sure-footed and we had some trouble keeping up. After a few curves and turns which I'm sure neither of us could remember, we suddenly came to a beautiful forest with a well marked trail descending out of the mountains. Our helpers accepted our gratitude and cheerfully returned to their home waiting deep in the mountains. I caught the wave of both children as we began our decent.

At the Edge of Modernity

We had not travelled very far before we realized the trees were bursting with tiny sparrows following us. In our Kingdom there is a legend that before becoming a Priest you must live as a sparrow first. I remember thinking that if this were true, our Kingdom would have many Priests soon! The little birds provided cheerful company for us and we could not help but laugh as they frantically made their way from tree to tree. The forest was very much like the King's Forest we had encountered so many months ago, except the wilderness more pristine with no evidence of markers placed by the King's Servants. This absence was a sure sign we had reached the furthest regions of the Kingdom. I expected at any moment to leave the forest and enter a new Kingdom.

The forest ended abruptly at the foot of the Mountains, opening to a large, white, featureless plain. A distant arm of the Lonely Mountains lay to the right, otherwise there was simply a vast expanse of snow and ice as far as the eye could see. The horizon seemed to melt into the sky, making it impossible to determine how far the plain continued. No trail existed in this desolate region, our only hope was to continue to travel and perhaps discover a trail or the borders of the next kingdom on the other side. I turned to Foucault and asked him what we should do. He put his hand on my shoulder and gently, but firmly, told me I must travel this last part of the journey on my own. Somehow, I was expecting this. I asked him if he would wait in this forest until I returned. He smiled in a very strange way and told me that I would see him again. I shook his hand, thanked him for all the help, guidance, and even torment he gave me in the past. "You are a worthy companion, Michel Foucault," I told him. I turned and stepped onto the plain.

Immediately a sharp wind tore at my face. I had to pull my jacket tightly around my head. Still, the wind seemed to cut right through my clothing making travel very slow and laboured. The snow was not deep, though, but with every step forward my previous footprint was erased by drifting, shifting crystals of ice. I turned my back to the wind and felt some relief as my back pack blocked the wind. It was bitterly cold. Then the wind shifted, blowing from the right and it was all I could do to keep walking.

It was not easy. In the distance I could make out the source of the wind: a mountain glacier in the shape of a giant angel. The wind seemed to be pushing me back towards the forest, demanding I return to the Kingdom, to safety and security. I could see still the deep green of the forest behind me. Foucault would still be there, waiting. Somehow I kept walking, my hands numb from the cold, my spirit sinking. The cold wind from the glacier tugged at my body, urging me back with strange, intense ferocity. I did not want to go on. I thought of the sparrows and smiled. I remembered the children in the chalet, those lives on the threshold of disappearing like so many in the Kingdom, and I was surprised by a deep resolve to continue, a force within urging me onwards. I had to try; my pace increased.

After a few hours the wind died down and the ground changed to bare rock with the occasional drift of snow. I was able to walk forward now, but nothing appeared to break the dark horizon ahead. A terrible sense of foreboding came over me as I walked in the utter, eerie silence of the rocky landscape.

I was so surprised by the sudden chasm that opened before me I almost walked right off the precipice. As far as I could tell the land simply came to an end. The divide seemed to travel forever to my left and right, with no land at all on the other side. I dropped a stone into the chasm, but did not hear the stone hit bottom; as far as I could tell the chasm was bottomless.

No rope, no bridge, no person could cross the abyss I faced. The horrible truth came to me, the awful conclusion to my journey screamed out: *There is no way out of this Kingdom.* I recorded in my journal how I felt at this abyss: "Trapped. Sad. Lonely. In the end, it's all worthless. I feel a sense of abandon, loss... my hopes are gone" (Journal entry, December 18, 1991). I had travelled all that way only to find that there is no other kingdom, there is no hope for the disappearing children and thus no hope for us all. Even if we fight the constant destining that pulls us back towards the centre of the Kingdom, even if we could travel to the very margins of what is, there we find only despair and hopelessness for our efforts.

I thought of my comrades happy in the eastern regions of the Kingdom and I wanted to be with them. I thought of my students when I was still a Priest, and I wanted to be with them. I thought of the family I met in the mountains, and I wanted to be there. Then I thought of my own family and most of all I wanted to be home. But I was not home; I was all alone at the edge of the Kingdom, wretched, utterly spent, and without hope. Before me lay the night of a bottomless chasm, behind the great anonymous waiting to take me back.

CHAPTER 5
HOPE AND POSSIBILITIES FOR CHANGE IN SCIENCE EDUCATION CURRICULUM-DISCOURSE

At the Chasm of Despair

When you look long into an abyss, the abyss also looks into you.
Nietzsche (1886/1966), Beyond Good and Evil, p. 89.

I don't know how long I had been asleep, but I woke suddenly, disturbed by a horrible dream. I imagined that I was falling, or rather sliding, almost imperceptibly into a deep, dark, quiet pit. I remembered in my dream looking up as the light around me constricted until all I could see was a small aperture of hope; this too closed until I was finally engulfed in the suffocation of nothingness. I then woke up, and although it was still not yet light, I was too frightened to return to sleep, too terrified the dream might return.

Wrapped in the warm comfort of my sleeping bag, I poked my head out of the little tent and surveyed my situation. Around me the land carried the stillness before dawn with the dignity unique to barren places. I recalled where I was: my tent was pitched a few meters away from the chasm at the edge of the Kingdom. No visitor would come my way, no feature broke the monotonous rocky landscape, no bridge would carry me safely across the chasm out of the Kingdom. I was utterly alone.

I dressed and stepped outside. Careful to note the position of the chasm, I put on my travel sack and decided to take a walk. A confident stillness surrounded me, but my thoughts overwhelmed the silence. How long had I been at the edge of the chasm now? It was hard to say. A certain timelessness pervaded this region, infusing life with the peace of desolation. That morning I pondered my future. Snow on the plain towards the Lonely Mountains provided pools of fresh water and I had ample stores of food, thanks to the generosity of the family in the chalet. Why should I return? Every effort back in my former life seemed destined to serve the status quo of conformity, to serve the power of a King long since missing. So, what was the point of attempting change, or trying to make a difference? Are we not condemned already by the systems of power in which we are both trapped and trappers? The desolation of this question provided an odd comfort in the failure of The Quest, of *my* Quest. There was something there, in that question, that gave pause to the bitterness of my location. And from this question came another: If there is no way out of the Kingdom, no map that can be made, no workshops on how to take the journey out, then is any effort to find a cure for the dis-ease of our young people futile? Is hope naive, are possibilities barren?

The chasm had an ominous presence and on that particular morning I felt drawn to look once again into the dark recesses of its innermost being. The predawn light was just sufficient for me to make my way to the edge of the Kingdom and the awaiting abyss. Like the mouth of some whale, the vast darkness of the chasm seemed to open before me, almost daring me to jump in. I stared into the void. No destination on the other side beaconed, no horizon was present: just a vast nothingness that appeared to extend forever. The phenomenon no longer unnerved me, so I sat on the edge, dangling my feet into the inky blackness. In fact--dare I confess this?--I new sensation was creeping into me spirit. For a few days I had noticed this new feeling, but was unable to identify it. Sitting at the edge of the Kingdom, I realized that morning what I was feeling: *I was bored.*

All of us need, I believe, times of refraction or recollection in our lives, time to restore energy and find once again what it means to find "the meaning of your own life" (Nietzsche, quoted in Miller, 1993, p. 303). But refraction is but a pause in the repetition of living, a moment to find direction before continuing adventuring once again. I realized that morning I had strayed away from repetition by recollecting only what had been, not recollecting forward (Kierkegaard,1843/1983) on what might be. Perhaps the security of indecision provided some comfort after the failure of The Quest, perhaps I had become lazy, or perhaps the darkness of the chasm infected my spirit. I was bored, to be sure, but not willing or perhaps not able to do anything about my situation. Glancing at a nearby puddle of water beside the edge of the chasm, I caught a reflection of my face. A chill ran down my spine as I recognized my expression: I had the same look as the children fading away in the Kingdom. Had their disease infected me?

Then I thought of Foucault. It was very odd, I had not thought of him for since I left the forest-- how long ago?-- but the memory he was waiting for me returned with force. Then I felt a new feeling: *I was lonely.* You may be surprised I did not feel lonely sooner, but solitude often provides a comfortable home. I realized, though, that it was not comfort I was seeking, but the exact opposite: *I longed for the discomfort that comes from being with others.* Yet I knew with certainty no one would find me in the isolated, rocky wilderness I had discovered. A wretched unhappiness came over me; waves of grief racked my being. "Is anyone out there?" I yelled into the chasm. But any hope of a response to my call, even an echo, was smothered by the cold, dark and impersonal silence. My thoughts travelled beyond the Mountains behind me and on to the Kingdom sheltered within. There awaits the more gentle horror of definition; I realized at the edge of the abyss that the Kingdom could no longer be my home. There was no place for me to live, no where for me to go; the bitterness as the hopelessness of my location overcame me. I knew the emptiness of the chasm was slowly but surely creeping into my spirit. I sat at this edge, cold and alone. I believe I sat there for a very long time.

Locations of Hope for Change in Science Education Curriculum-Discourses

Questioning builds a way.
Heidegger (1954/1977), The Question Concerning Technology, p. 287.

The First Book: Foucault's Pedagogy

Then the first rays of the Sun crept over the eastern horizon, spreading warm, light fingers across the rocky landscape. Hungry, I reached into my travel sack for something to eat. Instead of food, the first thing I touched was one of the books I placed in the sack the morning I began my journey so many years ago. I turned to these works now in my despair of hope and possibilities for change. The first book I removed was by Foucault (1976/1990), The History of Sexuality, Volume 1. A pang of sadness moved through me as I recalled my many travels with Foucault. The wrinkled cover and marked pages reminded me of days past when I frequented the pages of this work. I turned to a familiar passage, almost hearing the voice of Foucault once again in the words, "power is everywhere; not because it embraces everything, but because it comes from everywhere" (p. 93).

Through my journeys in the Kingdom I observed and experienced the pervasive defining and determining of modernity that is power within the Kingdom. Charged with the task of making a difference in the lives of children in the Kingdom, the team I travelled with were unable to find a way through the mountains that encircle the Kingdom. Just when the team seemed to make progress in the journey, procedures of power assured the status quo. Through the dual functioning of who could speak and what could be said during The Quest, power remained mobile, anonymous and effective in preventing change.

I thumbed through the book by Foucault, finding passages that resonated with my experiences in the Kingdom. Although Foucault was concerned with the fate of sexuality in the Great Conversation of modernity, I found in this work many direct parallels with the fate of the initiative to cure the dis-eased children in the Kingdom. Foucault suggests that in Europe during the eighteenth and nineteenth centuries human sexuality became a discourse in which "the sexual conduct of the population was taken both as an object of analysis and as a target of intervention" (p. 26). In the Kingdom, a similar effect happened as controversy over The Quest grew. Every move of the team became subject to the scrutiny of professional groups and teachers until the Quest became a discourse- a curriculum-discourse- open to analysis. This led inexorably to interventionist strategies by the very organizers of The Quest, a procedure I called bureaucratization in the previous chapter of this dissertation. Foucault quickly adds that a key interventionist strategy is silence, noting that silences form "an integral part of the strategies that underlie and permeate discourses" (p. 27). Indeed, I found the timely silence of some participants in the curriculum-discourse of the Kingdom strategically important in enabling other voices in the curriculum-discourse to distract the team from its original direction.

I closed the book, stood up and stretched. The sun was above the horizon now, casting golden rays over the forbidding landscape. I tried looking into the abyss before me, but the inky blackness so far remained untouched by the early morning light. I continued reading, careful to note the precipice as I paced back and forth. In The History of Sexuality Foucault observes how in the nineteenth century the discourse on sexuality came to focus on the child, strangely excluding the voice of children in the constellation of "parents, nurses, servants, educators and doctors" involved in the scientific study of sexuality (p. 98). The result, notes Foucault, was an ironic turn towards increasing marginalization of other voices in the family, in particular the mother, as the "sexuality of the adults themselves was called into question" (p. 99). The entire idea of family became increasingly complex, dictated more by scientific journals than the tradition of elder family members. I witnessed a similar effect of ironic turning during the Quest. The original vision for the quest rose from the practical concerns of people close to the voices of children. But as controversy began to direct the journey of the team, the voices of children and those closest to the children became marginalized as other issues and voices occupied the centre of the curriculum-discourse. This centring increased even when voices on the margins, the teachers, were eventually consulted. Ironically, consultation became another procedure of power, extending the defining reach of the existing curriculum-discourse. The teachers lost in this process the only voice left to them: a position of critique that comes precisely from being on the margins of a discourse. But power is relentless. As parents in the nineteenth century consulted with psychiatrists and newly published manuals on how to respond to the sexuality of their children, it was only a matter of time before the scientific study of sexuality would turn towards a focus on the parents, too, submerging these voices in the discourse on sexuality. In the Quest, power eventually extended to defining what central participants of the curriculum-discourse could say, a procedure I call ontological invasion in Chapter 4, completing a mobile nexus of power relations dependent on situating voices at the centre and at the margins of the curriculum-discourse.

The definition of who could speak in the curriculum-discourse limited what could be said; Foucault suggests this is due to the fact that in a discourse "power and knowledge are joined together" (p. 100). Certainly the modification and legitimation of hierarchies, the active marginalization of voices, and the strategy of consultation served to direct the focus of the curriculum-discourse to knowledge of the techniques of travel, such as map-making, and away from the original vision of change. This re-direction towards technique in the curriculum-discourse was dependent on the production of public truths that the team was somehow watering down the Quest by engaging in something that had become 'Mickey Mouse.' The result of these public truths was the direction of the team to orthodox, well-travelled routes when, in fact, the initial vision was travel in precisely the opposite way. The knowledge of traditional routes of travel was promoted through the development of a public truth that these routes were the best direction to go, but these routes led the team inevitably and surely back to the centre of the Kingdom: The precise effecting of power in this curriculum-discourse.

And not just in this curriculum-discourse. I sat down, and thought back to my studies of curriculum-discourses when I lived in the Kingdom. Despite considerable investment in personnel and funds, almost every modern curriculum-discourse has proven to be incredibly resilient to change (Blades, 1992a, 1992b; Cuban, 1982, 1984, 1990; Fensham, 1988a, 1993; Fullan, 1993; Hurd, 1991b; Sarason, 1990). In the great need to reform science education curriculum-discourses, resilience to change presents a crisis in modernity. This crisis is approached in curriculum-discourses in the spirit of the Great Conversation as a technical-rational problem. But technical-rational approaches to curriculum change have proved hopelessly barren and so the crisis continues. In the Kingdom children are still disappearing, in science education curriculum-discourse technicality blocks possibilities for change. In both situations what prevents change are the adaptable, anonymous, far-reaching, and mobile procedures of power epidemic to the Great Conversation. We are, quite simply, trapped in a conversation that defines who may speak and what may be said through procedures of power that ensure the continued dominance of a conversation that has become no longer relevant to the situation of our present age.

To this desperate situation Foucault provides, through example, a completely different way of understanding the failure of reform in science education curriculum-discourses. Foucault demonstrates precisely in The History of Sexuality how the rise of the discourse on sexuality led to what he calls the "perversion" (p. 36) of human sexuality:

> One had to speak of it as of a thing not simply condemned or tolerated but managed, inserted into systems of utility regulated for the greater good of all, made to function according to an optimum. Sex was not something one simply judged; it was a thing one administered. (p. 24)

A whole "grid of observations" (p. 26) resulted from this perversion as educational, medical, and penal institutions became fixated on "the question of sex" (p. 70). Sexuality became an object of clinical investigation, a scientia sexualis, a subject of technologies of self until the modern person has become full of sexuality, but no longer sexy. The consequence of this development is the further alienation of humanity from itself, a perversion that Foucault, drawing from Nietzsche, suggests originates in the "will to knowledge" (p. 73) that animates the Great Conversation of modernity and is expressed in procedures of power. Thus, Foucault presents a chilling prospect for curriculum studies: understanding why a curriculum-discourse does not change involves wrestling with the will to power that is the discourse; ultimately change is not a issue of technique, or even of power, change involves wrestling with the origins and activity of the perverse conversation of modernity itself.

Foucault suggests the trachealization of modernity can begin in dis-covering the procedures of power in discourses. What does the dis-covering of these procedures teach us? First, the events of the curriculum-discourse in the Kingdom were inevitable but not predictable. From the moment the team left on the Quest, their journey was destined to return them back to the centre of the Kingdom. The team originally set out on a journey that seemed well planned. There was not any particular set of factors that could have been considered which would have guaranteed a priori the success of the Quest. Such attempts at analysis of the team's journey in the Kingdom are shallow and consequently destined to barrenness because they are founded on structuralistic, technical-rational presuppositions of modernity which is the very conversation preventing change. A deeper, more profound, more difficult challenge is presented by the failure of the team in the Kingdom- and in other kingdoms- to find change in a discourse that is part of the Great Conversation of modernity; to find a post-modern vision for change. Without a post-modern vision, the mission of the team was doomed from the start to slow, but inevitable, failure, exactly as curriculum change attempts before and any future attempts approached as a modern, technical-rational problem.

Foucault's work also suggests a consequence of the inevitably of failure in curriculum change is the inability to predict the exact procedures of power destined to frustrate attempts at change. Of course, if the procedures of power were stable and uniform, one could propose a meta-theory of power which could then form a basis of subversion that might lead to change. But it is not that easy. Foucault's works suggest many procedures of power of particular discourses, but these procedures vary considerably depending on the discourse. For example, Foucault shows how procreative behaviour was increasingly socialized through economic incitements and restrictions as a procedure of power in the modernization of sexuality, but socialization of behaviour through economics is not a procedure presented in his discussion of the modern discourse of justice and systems of punishment or his interpretations of discourse of treating madness. The act of public confession figures as a prominent procedure of power in Foucault's understanding of prisons and punishment, while in the discourse of sexuality Foucault proposes that confession is a more private, yet still effective, procedure of power. Neither confession nor economic control of behaviour seemed to play a role in the events of the science education curriculum-discourse in the Kingdom, although perhaps a different researcher than I might see these; but the procedure of consultation, a major procedure of power in the Kingdom, is not given attention in Foucault's interpretations. These few examples illustrate how procedures of power vary from discourse to discourse, perhaps even within the same discourse over time. From a Foucauldian perspective, power is a moving target where the procedures are always discovered after the discourse is in place, making a theory of power and the predictability of procedures impossible.

A cold wind started to blow across the plain and I shivered despite the warm rays of the Sun. I walked back to my tent, placed the book by Foucault on the sleeping bag and put on a sweater. There was enough light to see into the abyss and although I knew from my days at this edge what I would find, I went again to look over the precipice that extended around the Kingdom. Light illuminated the situation I faced. The rock plain continued vertically over the edge of the abyss, a vast greyness that formed a continual drop into an apparently bottomless chasm extending to the horizon.

As I gazed into the expanse, I realized that the sheer cliffs before me, the barren plain behind me, and the distant haze of the Lonely Mountains towards the centre of the Kingdom held a certain, well, rugged charm. I thought of my colleagues on the team and wished they could be here, to share what I knew about the Kingdom. Then it suddenly occurred to me: Suppose the team *had* found a way through the mountains, through the forest and along the plain to the edge of the Kingdom, then what? I had travelled as far as one could go in the Kingdom, and I had not discovered a cure for the disease of children, either. The horror of the next thought overwhelmed me so much that I almost fell into the abyss: *What if there is no cure?* Suppose the children, indeed all of us, are completely, absolutely doomed to the status quo? Suppose there is no hope for change, suppose possibilities do not exist?

Unnerved, I decided to continue my walk. Alongside the abyss I fell into a rhythm of walking that freed my mind to consider further what Foucault had taught me. For the first time during my journeys, serious questions about Foucault's conception of power grew in my thinking. I could see Digeser's point (1992) that if power lies "at the bottom of all our social practices: politics, medicine, religion, psychiatry, work" (p. 980) then essentially power "is everywhere. There's no escaping it" (p. 980). Digeser observes that in all other conceptions of power there is "always the possibility for human relationships not to be mediated by power" (p. 981). But Foucault, claims Digeser, does not define power in opposition to freedom: To Foucault there is no arena where power has no play. Bernauer (1990) agrees with this perspective on Foucault's concept of power, bluntly adding that if we accept Foucault's view of power then "one always exists within a specific deployment of power, and to nurture a wish to be outside of power is merely to cultivate a private fantasy" (p. 150).

But it seemed to me the Foucauldian thesis that power is everywhere, inescapably constituting and being constituted by discourse, presents two serious problems. First, it is difficult to establish the validity of Foucault's claims. The writings of Foucault are, of course, also a discourse. As a form of interpretation of our modern situation, Foucault's writings are, by the very thesis animating his writing, also a discourse mediated by power and thus must remain suspect and open to critique. Dreyfus & Rabinow (1982) invoke a medical metaphor to illustrate this point: "A doctor can stand outside a patient and treat him objectively, but a practitioner of interpretive analytics has no such external position. The disease he [sic] seeks to cure is part of an epidemic which has also affected him" (p. 202). Thus, Foucault's conceptionalization of power invokes a paradox: If what Foucault claims about power is valid, then it is possible his own work is part of a modern strategy of power in the discourse of philosophy, possibly leading us not towards an understanding of our modern situation but further away. The crux of this irony in Foucault's concept of power is what Rochitz (1989/1992) claims to be the "secret universalism" in Foucault's oeuvre: Power achieves a historical transcendence that is ultimately deterministic and thus completely modern (Habermas, 1985/1992; Kurzweil, 1983; Megill, 1985; Poster, 1989; Roth, 1992). If true, this criticism suggests an unpleasant dilemma: How valid are Foucault's insights if they present a view of power that in scope and elaboration suggests a deterministic meta-theory of power, since the modern urge to present global, totalizing theory is precisely what Foucault claims to be fighting in his work? After all, if power is as totalizing as Foucault seems to suggest, how can his claims about power hold validity? Would these claims not also constitute part of the business of power and thus remain suspect and open to critique? How is Foucault able to exempt himself sufficiently from the effects of power to judge its effects? (Digeser, 1992).

This questioning led me to the second serious problem in Foucault's concept of power. If power is everywhere, constituting all aspects of the social order, are we not drawn into an endless vortex of nihilism? After all, it's one thing to see a situation clearly, quite another to propose what to do. The "dark realism" (Boyne, 1990, p. 130) of the pervasive nature of power leaves us with a difficult, important question: "Where do we go from here" (p. 130)? Or, perhaps more darkly, *Can* we go from here? I stopped and surveyed the expanse beside me, stretching endlessly to the horizon. During my travels, and especially along the Last Lonely Road, I felt I had come to know Foucault. Was my travelling companion really suggesting that every human action is completely predetermined to be a manifestation of procedures of power? Is it possible to speak of power, to work against power, without evoking defining metanarratives about power? Are we condemned to the pervasive, effective power of modernity? In the second great crisis of renewal in science education, can we speak in any way apart from the Great Conversation, or has Foucault simply elucidated some of the procedures of our entrapment, leading us to know more fully our hopeless situation? Here I was, at the edge of the Kingdom. Is my location a metaphor of what a study of the procedures of power teaches? The only direction of travel open to me was back towards the centre of the Kingdom; indeed, this was the only direction for anyone, including the team, who might make the journey past the mountains. Then I came to know with complete certainty our modern situation: *There is no other kingdom, all we have is the kingdom we are in.* And if Foucault's elucidation of power is right, change in any discourse may well be beyond the reach of those in the discourse. I returned to my original assessment of the chasm at the edge of the Kingdom: We are hopelessly trapped. My elaboration of the procedures of power in the Kingdom seemed to only clarify the nature of the entrapment I discovered in my journey. From this assessment came a distinctly modern question: Now what?

Somehow, some way, there must be a way to help the children in the Kingdom, to find a cure for the disease. Yet I could not see a way out of the geography of the Kingdom and....

Excuse me! There is a knock on my door. I'm writing this section at my desk in my university office and I need to attend to this interruption. We will resume our conversation later.

(The First Interruption: Encouraging Beginning Voices)

I open the door to find Desireé, one of the students in an undergraduate science education methodology class I teach. I smile, greeting her with a "Hi, Desireé," and an invitation to sit down.

"So," I begin, "how can I help you?"[1]

She opens her notebook. "I wanted to ask you a question," she tells me. "You said in class today that there's been a declining interest among students in a career in science."

"Yes," I answer, "and my research with students (Blades, 1992a) also shows that students in secondary schools find their science classes boring and not relevant to their lives."

"O.K., but you also said that hope for change in all this lies with beginning teachers, like me." I nod agreement. Desireé then asks, "Well, my question is, how can a beginning teacher make such a difference? I mean, my friends doing their final practicum tell me that its all they can do to survive. Everyone knows your first few years are crazy and, well, I just wondered if...well..."

"If perhaps what I'm saying is out of touch with the realities of classroom life?" I venture.

She smiles. "Something like that."

It was a fair question. I was teaching these students they could make a difference in science education, that they were at the front lines, so to speak, of reform. And I believe it to be true. In fact, the possibility that beginning teachers could make a difference in the discourse of science education, and that I might play a role in encouraging this difference, was one of the reasons I left my high school classroom for a career at university. I thought of Desireé and her peers: Greg, Sherry, Jonathan, Steve, Kim...all of my students young, dedicated, eager teachers excited to teach children science. How could I encourage these beginning voices- give them courage- to truly make a difference? What could I say to Desireé; what could I say to my students?

I can begin by engaging Desireé, and her peers, in a conversation of critique.

"Remember in class how we explored stereotypes of scientists?" I ask. She nods. "What did the brainstorming exercise teach you?"

She laughs. "I was surprised," she confesses, "to find how many stereotypes of science *I* had. Our whole group laughed a lot as we shared stereotypes of scientists we had seen in films and movies. But," she adds, "I think the part of the lesson I liked the best was the way you showed us how the scientific method was not the rational access to truth we were taught in school."

---

[1] The conversation that follows is somewhat metaphorical and is drawn from my experience teaching undergraduate students courses in science education methodology and comments students have made in their evaluations of my courses. "Desireé" is a fictional name. Our conversation is quite typical of the many I have in my office.

"Why did you like this part the best?" I inquire.

"You see, Professor Blades... I hate to tell you this, but, well, even though I was good at it I *hated* science when I was in school. It was so, well, boring. Those things you shared about what students had to say about their science classes? That could have been my voice."

"That's O.K., Desireé," I respond, "most students tell me how much they hated their school science. Some, of course, also tell me they enjoyed experience with school science. But I'm curious, what did you enjoy about our discussion about the scientific method?"

"What you said about science and other fields," she says decisively. She glances at her notes. "You said...wait I have it here:

> We have a wilderness of mystery to make our way through in the centuries ahead, and we will need science for this but not science alone. Science will, in its own time, produce the data and some of the meaning in the data, but never the full meaning. For getting a full grasp, for perceiving real significance when significance is at hand, we shall need minds at work from all sorts of brains outside the fields of science, most of all the brains of poets, of course, but also those of artists, musicians, historians, writers in general. (Thomas, 1983, p. 150)

She closes her notebook. "You see," she continues, "this is a whole new idea to me. I always thought science and math were the most important subjects, at least in our school that's how it was. If you weren't good at science, well..."

"You felt like a failure?"

"Not really, more like you were made to feel not very smart. I was good at science, so I was O.K., but my best friend was good at art, but that didn't seem to count."

"Why not?"

"Because to get into university you needed science, and she also wanted to be a teacher. So, you can imagine how both of us felt when we found out that to become teachers we would have to take more science courses at university!

"And how do you feel now?"

"I can't believe it, but I actually like science now! It's fun."

"What changed your mind?"

"Well, I really enjoyed some of my university science classes-- some of the profs are excellent-- but I think my attitude changed when I realized in your class that science can be fun, and that science is not the most important way of knowing about life, just one way of knowing. Also, I'm looking forward to our class on environmental education. I think it's important we teach kids about how they can help heal the world."

"Desireé," I began, "although I'm no longer teaching in schools full time, I spend a lot of time there. In these schools I still see students having the same experience with science that you and your friend had when you were in school. You first asked me how you could make a difference in the lives of the children. I would say that if your students learn that science is something you *do*, a human activity full of fun, adventure, and limits like all human activity, important but not any more important that other types of human activity, then the children you teach will come to see science differently that you did and perhaps they will appreciate and understand science better. If you can do this, then you *will* have made a difference in science education."

Desireé ponders this thought for awhile, then rises to leave. "Thanks, Professor Blades. I see what you mean. Now I'm excited to teach children science!" She laughs. "Who knows? Maybe I'll make science my major!" She leaves the door open.

Maybe she will. Lots of students, when they realize how fun and exciting science can be, do change majors. Although this conversation interrupted my writing, I was glad to encourage Desireé, I always enjoy engaging my students in conversation, helping them to find a vision of what could be.

But I know the odds are against them. Once out in the schools these young teachers face an "institutional opposition or inertia" (Gruender & Tobin, 1991, p. 6) reflected in a welcome by their experienced colleagues to the so-called real world where the advice and examples of university professors are dismissed as the suspect ravings of ivory tower theorists on the fringes of educational practice. Wood (1990) reminds us that these beginning teachers have also experienced through their schooling a "10,000 hour 'apprenticeship of observation' and this apprenticeship is a powerful shaper of teacher belief and actions" (p. 30). In the frenetic life of a new teacher, the siren of transmissional teaching, a conveyance of facts where students are required to depend "unquestioningly on the authority of the teacher" (p. 6), will beckon through the examples of experienced colleagues and the remembered experiences of once being a child in school.

Desireé has left my office, but the interruption of her visit left questions behind. How can I encourage these beginning teachers to teach an authentic view of science as a "human and social activity" (Bernie, 1991, p. 27), to continue developing an STS approach to science education? In an age when teaching is increasingly becoming "not more than narrow technical skills" (Ryan, 1989, p. 18) how might these new teachers "enlist students as active, critical participants in the learning process" (Gruender & Tobin, p. 6)? Is there any way professors of education can support their students in the difficult task of retaining a voice of critique of what is once students graduate and (hopefully) find a classroom? Is the critique of science and science education offered in a methodology class enough? Is the development of this critique what beginning teachers need to make a difference in science education? Is it realistic to expect these voices alone can effect change in the long-established and quite resilient curriculum-discourses of science education? Might this critique find avenues for change through research partnerships between beginning teachers, university professors, experienced classroom teachers and children in schools?

The Second Book: Heidegger's Warning

Beside the door to my office is a book shelf. Glancing over the texts arrayed there, I find The Opening of Vision by Levin (1988). I allow the book to open and notice that I have marked the following passage:

> Deep spiritual wisdom, deep enlightenment, lies hidden in the visionary being with which we are gifted in the innateness of childhood... But it is much harder for us, living in society, a world, a reality brought forth out of so much blindness, to see in that way. The historically given culture in which we live is itself more closed off from the presence of Being and its enchantment of vision. (p. 58-59)

Where did this blindness come from? What has caused the loss of Being Levin speaks of? I glance at my desk and remember the narrative I am writing. I sit down and pick up my pen, and we are transported back to the abyss at the edge of the Kingdom.

But as I stood before the vast chasm, the words by Levin continued to echo in my thinking. What does he mean by a loss of vision? I sat down, dangling my feet into the sombre greyness before me. The afternoon Sun was warm and I felt sleepy. I surveyed the chasm once more. The horizon was not broken by the promise of anything different. Below, an infinite fall that disappeared to a blackness the sunlight could not reach. But today, inspired perhaps by Levin's comment, I continued to look.

At first, the haunting landscape of the precipice was as I found it every other time I looked over: a uniform wall of featureless grey rock. But this time I thought I noticed something different, a movement perhaps. I imagined that I saw a small sphere, like a black softball, moving along a straight path along the void. I found it hard to estimate the size of the object or its trajectory, but I recognized the object from pictures I had seen: It was the satellite Sputnik. As if in a dream, I followed the satellite until it was out of sight. I heard the now familiar moan as wind rushed into the abyss. But a new sound rose from the depths, the unmistakable sound of a baby crying. I looked for the source of the sound and somehow the light along the cliff face formed the shadow of a newborn child. And I knew the child was me, born only a few years before the launching of the first human-made satellite. An eerie series of visions appeared to me that afternoon. I saw scientists at the Wood's Hole Conference commissioned to work on science education reform in the United States in the interests of national defence. Then I could see myself as a young boy, holding a bucket of 20 or so garter snakes I had captured to study. I remembered my father built a cage for the snakes, assuring my mother the snakes could not possibly escape. I laughed out loud recalling the shriek from the kitchen as my mother discovered one of my snakes in a kitchen drawer!

Had I always been interested in science, or was a scientific interest nurtured in my upbringing? It was hard to say. Chemistry sets, electronic kits, microscopes and telescopes dominated my birthday gifts. I grew up in an era when all my friends, at least all my male friends, wanted to be scientists. I saw myself building models of Titan rockets, watching the original Star Trek series, reading novel after novel of science fiction. Then I watched the shadows narrate the landing of the Eagle spacecraft on the Moon. I felt again the thrill of the world as I watched, transfixed, as Armstrong climbed out of the craft to stand on the Moon. A deep sigh came over me. Those were the days. If we could land people on the moon, I thought again, surely we could find a cure for the disappearing children in the Kingdom. After all, had I not grown up with the new found cure for polio? Was not smallpox eradicated when I was a boy? Millions of children used to die from complications due to infections, but the development of powerful antibiotics before I was born enabled my generation to weather childhood diseases generally without harm.

My thoughts travelled back to my house back in the Kingdom. Through science and technology I could enjoy the quick convenience of a microwave oven, control over TV with my VCR, absolute fidelity in musical recording with my CD player, and ready access to information and production of text and graphics with my powerful microcomputer. I could enjoy relatively accurate weather predictions thanks to an application of satellite technology. Perhaps the modern promise of a better life through science and technology (Johnson, 1991) was true.

But the narration of the vision was not over. I saw the horror of napalm in the Vietnam war, the technologically sophisticated terror of carpet bombing and the perverse rape of the jungle by Agent Orange. With complete incredulity I watched myself as a young boy practicing with my classmates how to dive under our desks and cover our heads during routine drills for protection in the event of an attack by nuclear weapons. DDT, Silent Spring, Thalidomide children, Three Mile Island- I witnessed the slow growth of crisis in a generation raised on faith in science and technology to progress. I did not want the next vision to appear, but I knew it was coming and somehow I could not turn my eyes away: I saw the sudden, tragic death of astronauts in the explosion of the space shuttle Challenger, a horrific exclamation mark to a text that spoke of the loss of faith in the promises of modernity. The promise of Apollo became the horror of Challenger; a deep sadness and sense of loss filled my soul. I stood up and turned away from the abyss, unable to bear the visions I found there, confused about the message these visions held. The words of the poet e. e. cummings (1962) came to visit as I stood along the edge of the abyss:

pity this busy monster,manunkind,

not. Progress is a comfortable disease:
your victim(death and life safely beyond)

plays with the bigness of his littleness
--electrons deify one razorblade
into a mountainrange;lenses extend

unwish through curving wherewhen till unwish
returns on its unself.
A world of made
is not a world of born--pity poor flesh

and trees,poor stars and stones,but never this
fine specimen of hypermagical

ultraomnipotence. We doctors know

a hopeless case if--listen:there's a hell
of a good universe next door;let's go (p. 554)

I remember this poet once observed that we "can never be born enough" (cummings, 1969, p. 436). What did he mean there's a universe next door? How is finding this universe part of "a world of born?" (p. 436). I had been travelling a long time, but I felt no closer to helping the children in the Kingdom that when I first started my journeys many years ago.

It was way past lunch, and the break in the visions from the abyss allowed me the chance to realize I was hungry. I returned to my tent and reached into my travel sack, but instead of food I once again found one of the books I had brought with me on my journey. It was The Question Concerning Technology by Heidegger (1954/1977). Heidegger begins this short book with the cryptic phrase that the "essence of technology is by no means anything technological" (p. 287). But then he adds the explanation that "we shall never experience our relationship to the essence of technology so long as we merely conceive and push forward the technological, put up with it, or evade it" (p. 287). Heidegger then proceeds to make a distinction between instrumental definition of technology as the application of scientific ideas, i.e., tools, equipment, etc. and an anthropological view of technology, that is, the means by which certain ends are achieved. Heidegger then asks a key question: Suppose technology was more than either of these two conceptions? By linking the bringing-forth (poiesis)[1] of something to technology, Heidegger deftly turns process into a question that discovers the essence of technology: What does technology itself bring forth, or reveal? Thus, Heidegger concludes that "technology is therefore no mere means. Technology is a way of revealing" (p. 294).

What does technology reveal? Through the example of the construction of a hydroelectric plant on the Rhine river, Heidegger suggests "the essence of modern technology shows itself in what we call enframing (Ge-stell)" (p. 304). The German verb Stellen (to set upon) is also used, Heidegger notes, to mean "producing," or "presenting" (p. 302). Then Heidegger reaches a profound insight. Ge-stell is an active process, a type of producing a particular revelation, that is, a particular way of seeing the world: A technological way. Heidegger calls this revealing *destining* (p. 306). I note that I marked a passage that to me is the central point of Heidegger's claim:

> The essence of technology lies in enframing. Its holding sway belongs within destining. Since destining at any given time starts man [sic] on a way of revealing, man [sic], thus underway, is continually approaching the brink of possibility of pursuing and pushing forward *nothing but what is revealed in ordering*, and of deriving all his standards on this basis. Through this the other possibility is blocked. (p. 307, emphasis mine.)

In fact, Heidegger claims the destining of revealing of technology is "is in itself not just any danger, but *the* danger" (p. 308, his emphasis). Kim (1991) explains the nature of this danger. Speaking about a technological way of seeing, Kim observes that in modernity

> the world is looked upon as just so much raw material waiting to be used up, to be shaped and transformed by labour. For modern human being, to be is to be re-presented, or posited (gestelit). Heidegger calls this new understanding of Being "*Ge-stell*," or the "enframing." He says in terms of his use of it to speak of the gathering-place that accomplishes in itself in techne as a bringing-forth that delineates, shapes, and reveals. When Being has withdrawn, ge-stell can but speak of a despoiling, structuring, a delimiting that brings everything, to appear only as a semblance of itself. It is as this enplaning, annihilating summons that modern technology holds

---

[1] Heidegger notes that *poiesis* is a Greek term used in Plato's Symposium to mean "to bring forth," related to what an artist or craftsperson produces and reflected in our modern word "poetic." The *ability* of the artisan or craftsperson to bring something forth is called in Greek *techne*, from which our word technology derives.

> sway. Ruled by this claim, human being is estranged from oneself in the modern age. (pp. 49-50)

It is dealing with this estrangement that was the life work of Heidegger: The struggle to recover Being by finding and maintaining a critical spirit towards those essences, such as modern technology, that continually threaten the closure of Being (Krell, 1977). But how do we find this critical spirit? How can we avoid the destining closure of being from modern technology? Heidegger quotes the German poet Hölderlin:

> But where the danger is, grows
> The saving power also. (p. 310)

What does Heidegger mean by this? Sawicki (1987) suggests Heidegger maintains the conviction with the quote that "all thinking in the modern age will not be reduced to technological thinking" (p. 165). I marked my spot in Heidegger's text and stepped outside my tent, the thought of food long forgotten. Heidegger presents the situation of modernity with astounding clarity, but also suggests there also exists salvation from the defining entrapment of technicality. Where is this salvation? How might it begin?

I continued to read, pacing the ground between the chasm and my tent. Heidegger (1954/1977) suggests that through "essential reflection upon technology" (p. 317) we may yet reach a decisive confrontation between what is and what could be, leading to an opening for other possibilities of being. Exactly as the poet cummings suggested, change is a matter of being re-born, a question of being. And how does this journey to change being begin? Heidegger calls us to *questioning* with the conclusion that "the closer we come to the danger, the more brightly do the ways into the saving power begin to shine and the more questioning we become" (p. 317). Thus, questioning is not a technique to overcome technology, but a way of being that opens Being and, in so doing, may free us from the destining of technology.

Questioning. Question. I closed Heidegger's work and thought about the word question. From the Latin 'quaerere,' to ask, the word also means 'to seek,' from which we derive the English, quest. Thus, seeking and asking are bound in the word question, a word that also asks, what Quest-I-on? What Quest was I on? It was a good question! Well, I wanted to find a route out of the Kingdom; I had been on a quest to cure the children in the Kingdom of their horrible disease.

Like the members of the team, I believed it was a matter of finding the correct route, of travelling the right roads and the formula for curing the children would be discovered. Somewhere outside the Kingdom, we were convinced, the answers to our problems could be found. None of us imagined, least of all myself, that the Kingdom was surrounded by an uncrossable abyss, we simply had faith in... In what? I stopped pacing. In what?

A cold lump grew in my stomach and I began to feel sick. I knew where our faith lay and what our quest had become. It was all painfully clear. Sincerely concerned about the fate of our children in the Kingdom, everyone in the Quest, including myself, had slipped imperceptibly, comfortably, into technological thinking as we tried to find the correct route out of the Kingdom. We had assumed that curing the children was a matter of technique: Gather all the right people together, engage in the right Quest, travel in the right direction, and the children would be cured. Our Quest was founded on the technical search for The Answer, what I called the technical-rational approach to curriculum change in Chapter 2 of this dissertation. But the destining of modernity revealed the futility of our Quest, leading the team to the status quo while blocking any other possibility. Then I knew what Foucault meant by the word power. I recorded in my journal that day:

> A discourse is clearly framed by the larger discourses in society. It's nearly impossible to move beyond technicality in curriculum change when our culture is destined to think in modern ways. It is also bigger than all of us, a great anonymous force that really *is* power- in a "powerful" way, so to speak. The question is: "Oh, great! Now what?" (Journal entry, June 22, 1992, emphasis in the entry)

Completely ill, I looked once again in the abyss. The visions were still there, but this time I could see them all at once. They provided a panorama of my own careful definition: I became a thoroughly modern man, nurtured by faith in science and technology as a child, lacking a critical voice as a university student, and dedicated to modernity as a science teacher as I worked with evangelistic zeal to maintain the Great Conversation of modernity. I was not merely a participant in this conversation, I *was* this conversation and it was me. Then I knew the abyss I had reached at the edge of the Kingdom was mine. I had constructed it, or allowed its construction, I maintained it and invested in it; it was my being: a vast wasteland of greyness that is wretched, torn, exhausted, and made colourless by the empty promises of Modernity. I realized looking into my abyss that change is not, can never be, a question of technique. Change, true change that makes a difference in lives, must explore *questions of being*. I recoiled from this revelation in horror and terror. I had not expected my journey would turn out this way, would turn on myself. I did not want the fate of the children tied to the very discourse of a life- *my* life- to a conversation that included questions about who I am, why I live as I do and how else it might be.

I turned and ran as fast as I could from the abyss. Past my tent, on to the plain I ran in a cold sweat that came from fear. Finally, out of breath, I stopped right at the place where the snow began on the plain. I thought I saw, for a moment, the forest along the mountains in the distance. Foucault might still be waiting for me there. Somehow, that thought gave me courage. I knew why I had run, what I *really* feared the most: I was terrified of the personal responsibility of change, worried that even with an ontological turn to questions of change, there still might be the possibility that "nothing will happen" (Olkowski-Laetz, 1989, p. 183).

But Heidegger seemed confident that "questioning builds a way" (p. 287). Levin (1990) also seems hopeful that change is possible. He suggests a point where questioning might begin:

> If we do not interpret enframing experientially, as, for example, something which actually *happens* in the field of our vision, we may miss an exceptional opportunity to work with ourselves and prepare for a vision which could participate in the advent of a different historical existence. (p. 74, emphasis his.)

But how might we interpret the experience of Ge-stell? How can we investigate *how* we are enframed? Would such an investigation reveal possibilities for the other, reveal hope for change? I glanced up, convinced that I could see the forest as a thin green line highlighted by the clear light of the late afternoon.

I thought of my travelling companion Foucault. His elaboration of particular procedures of power through a Nietzschean investigation of "specific histories of technological practices" (Sawicki, 1987, p. 168) allowed Foucault to go beyond Heidegger's project by calling into question "modern notions of self, society, and history by showing how they have been constituted" (p. 168).

Sawicki notes that in this way Foucault is in the business, like Heidegger, of combating technological nihilism, although Foucault's historicities are

> designed to make the present seem less inevitable...not in the discovery of the essential features of the human situation, in the complete mastery of reality, or in releasement[1], but rather in "rebelling against the ways in which we are already defined, categorized and classified" by the dominating technologies of power. (p. 169)

While Heidegger sought to fight against the Ge-stell of modernity through a recovery of Being, Foucault adopts a more pragmatic stance: He invites us by example to dis-cover how Ge-stell works so that we can fight it.

But does this not present, once again, a dilemma? Earlier I raised concerns that Foucault's concept of power might not be valid, or possibly could be seen as deterministic meta-theory. Foucault was, in fact, asked this very question: "Can you, too, not be criticised for seeing power everywhere, and, in the final analysis, of reducing everything to power?" (Foucault, 1978/1988, p. 104). In that interview Foucault characteristically avoided the question, choosing instead to cite examples of what he termed the "problem of power" (p. 104). In an earlier interview Foucault (1983/1989h) claimed he was not a "theoretician of power" (p. 254). He explains that "when I examine relationships of power, I create no theory of power. It is how relationships of power interact, are determining elements in every relationship which I want to examine" (p. 254). Ryan (1991) suggests that Foucault refuses to grant power ontological status by consistently changing the question "What is power?" to questions about how power is exercised (p. 110). This questioning has validity, suggest Dreyfus & Rabinow (1982), precisely because Foucault admits to sharing our modern situation. They point out that Foucault "offers us, from the inside, pragmatically guided accounts" of the "organizing trends in our culture" (p. 203). It is these accounts, suggests Thiele (1990), that offer hope in our modern condition:

> Yes, our words and deeds, moral and political, are always suspect for their tainted origins and strategic implication; for there is no philosophical realm from which we might speak the truth to power. But no, we are not then left without any premise or purpose of our actions. There is indeed a legitimation for struggle, namely, the perpetuation and amelioration of the conditions that make struggle itself possible. (p. 918)

---

[1] Which Heidegger proposed would open possibilities blocked by technology.

Thiele describes Foucault's political project as "the valorization of struggle" (p. 918) that is valid and hopeful since "it is the human condition to exist within a system of power; it is the human potential to incessantly resist its reach, relocate its boundaries and challenge its authority" (p. 918).

This assumption of the human condition permeates Foucault's discourse on power, presenting an underlying stance of what might be called pessimistic hopefulness (Foucault, 1983) in the face of modernity. The extent and effectiveness of power invokes a certain pessimism in the face of the task ahead of us, indeed it would be easy to become deterministic about power from a reading of Foucault's work. But this would be a superficial reading of Foucault, claims Bernauer (1990), since Foucault's work is also an invitation to "dissident thinking" (Bernauer, 1990, p. 121) founded on the realization that "the other side of power's pervasiveness is precisely the omnipresence of the resistance it discovers" (p. 150). Deleuze (1986/1988) agrees that Foucault also suggests hope in resistance since "power does not take life as its objective without revealing or giving rise to a life that resists power" (p. 94). Foucault (1976/1990) makes this observation in The History of Sexuality:

> just as the network of power relations ends by forming a dense web that passes through apparatuses and institutions, without being exactly localized in them, so too the swarm of points of resistance traverses social stratifications and individual unities. (p. 96)

Foucault suggests, very cautiously, the strategic codification of these points of resistance makes "revolution possible, somewhat similar to the way in which the state relies on the institutional integration of power relationships" (p. 96). But revolution is always a local event to Foucault. He assumes individual responsibility for action at points of resistance (Gordon, 1980), although he suggests that helping other people "get their own struggles going in specific areas" (Foucault, 1983/1984c, p. 376) would be a post-modern ethical practice. Aside from this comment, Foucault preferred to demonstrate his ethics through personal involvement in prison reform and other areas involving human rights (Eribon, 1991; Miller, 1993). Change, in Foucauldian terms, is clearly a local event, a type of specific guerilla warfare (Poster, 1989) involving the relentless trachealization of discourses that attempt to define who can speak and what can be said, a call to a way of living Foucault called "critique" (Miller, 1993, p. 302). Foucault (1982) explains that by 'critique' he refers to the act of

> showing that things are not as obvious as we might believe, doing it in such a way that what we accept as going without saying no longer goes without saying. To criticize is to render the too-easy gestures difficult. (p. 34)

In other words, to continuously question so as to fight the "distortions, systematic or otherwise, that constantly menace our conversations, the ones we pursue with our own self as well as those we pursue with others" so that we can "maintain the openness of the conversation and keep it going" (Madison, 1990, p. 169).

I stood up, stretched and walked back to my tent to place the book by Heidegger back in my travel sack. The title of the third book I had brought had slipped my mind, and I was curious which one I had chosen. I also was very hungry. Returning to my tent, I thought about Heidegger's point that hope lies in the recovery of Being by maintaining a critical spirit towards that which continually threatens the closure of Being. This was very close to what Foucault meant by living critique, but Foucault has given us some advice as to *what* we could critique: the procedures of power that define who can speak and what can be said. I turned and looked over towards the edge of the abyss. When I first arrived at this location the chasm seemed to me a horrible barrier to change, a geographical Ge-stell that prevented me from leaving the Kingdom of modernity. Is there another way of seeing this abyss? An idea began to form in my thinking. Maybe the chasm...

Another interruption! Please excuse me once again, there is *another* knock on the door to my office. I apologize- I feel like we will never finish our conversation!

(The Second Interruption: Challenging Experienced Voices)

Will pokes his head through the open door, knocking on the door frame. He is one of the graduate students I supervise. He often drops by and I always look forward to his provocative questions. "Gotta minute?"

"Sure Will," I reply. I put down my pen and with some reluctance I leave my dissertation for the moment. "So, how's thesis proposal progressing?" I ask.[1]

"That's why I'm here," he explains, "I've run into a problem."

"What problem?" I ask.

"O.K., you remember I wanted to do my research on environmental education..."

"Right," I interject, "you were interested in developing a new environmental education program for the province."

"Well, I *was*," Will confesses, but lately I've been reading this book by Orr.[2] Now all I have are questions."

"Such as?" I invite.

"Well, Orr argues that our present environmental crisis "cannot be solved by the same kind of education that helped create the problems" (Orr, 1992, p. 83).

"I agree with him," I add.

"I can see his point," Will tells me. "This week in my curriculum class we read a paper by W. Doll (1989) that says we need 'to challenge the modernist assumptions on which our present curriculum is founded' (p. 252). Do you remember the book by Oelschlaeger I told you about?

"You mean, The Idea of Wilderness (Oelschlaeger, 1991)?"

"Yes," Will continues, "well, in that book he gives a good description of how our modern era was founded on the belief in the positive value of transforming wilderness (Chapter 3)."

"After your recommendation I decided to read the book," I remark. "I remember Oelschlaeger described modernity as a historical movement as through 'science, technology, and liberal democracy modern people hoped to transform a base and worthless wilderness into industrialized, democratic civilization' (p. 68)."

"Exactly. That book was a turning point for me," Will tells me. "I began to see how the modern project viewed wilderness as an object to exploit, not as what Cheney (1989) provokingly describes as a 'player in the construction of community' (p. 128)."

"This is new to me, Will," I tell him. "Can you explain what you mean?"

---

[1] Similar to the conversation with Desireé, the conversation that follows is drawn from my experiences with students engaged in graduate study in education. "Will" is a metaphorical name.

[2] Orr, D. (1992). Ecological literacy: education and transition to a postmodern world. Albany: State University of New York Press.

"I'm still working through it," he admits, "but I like the idea of wilderness as a voice that can speak to us. Orr calls this having 'a dialogue with a place' (p. 90)."

"What do you like about it?" I inquire.

"Well, Kohak (1984) argues that with the expansion of technology we have 'translated our concepts into artifacts, radically restructuring not only our conception of nature but the texture of our ordinary experience as well' (p. 12). This restructuring took humanity from a biocentric (humans as only one element in an ecosystem dynamic) to an anthropocentric view (humans-centred view of life). It seems to me that we need to recover a biocentric view (Guha, 1989) if we are to survive. At least, that's what I think Orr is saying in his book."

"But how can we achieve this new view, Will?" I ask.

"I'm not sure. I think part of this recovery involves a rethinking of wilderness, somehow listening to the narrative of nature, and realizing that we humans are not apart from nature but instead are part of it. I think this is what Orr means by a post-modern view of environmental education."

"I agree, I think this is what he argues."

"But this leaves me with a big problem!" Will tells me. "I was planning an environmental education program for the whole province..."

"And?" I encourage.

Will sighs. Well, I'm beginning to think that maybe such a proposal is too technical..."

"Too modern?" I suggest.

"Exactly," Will responds. The more I read about post-modern environmental education and the further my studies in curriculum, the harder it is for me to see my project the same way."

"What do you mean?" I inquire.

"My studies in curriculum have opened a Pandora's Box," he explains. "My whole awareness of educational issues has expanded. I used to think that changing the curriculum was simply a matter of developing a new program and giving it to teachers."

"Yet, did you not find that when you received programs for your classroom you changed them to fit your local situation?" I wonder out loud.

Will bursts out laughing. "All the time!" He says. "But I also changed them to what I thought was best for the kids. I guess my studies have shown me that the whole issue of curriculum and, in particular, curriculum change is more complex than I thought. In a way, I feel like my eyes have been opened now."

"Opened to what?" I inquire.

"To new ideas. I no longer take things for granted, like curriculum documents. I see the hidden curriculum of these documents and I know I'm more critically aware now of what goes on in schools. I think I understand what you call the agenda of modernity now. "

"This brings us back to your Thesis," I observe. "When you first arrived you mentioned you had a problem. What is that problem, Will?"

He smiles. "Just this: How can I develop a program for the province that adopts a post-modern approach to environmental education?"

"I'm not sure that you can," I confess.

"I was afraid you'd say that!" Will laughs. So, now I have a whole new set of questions. What would a post-modern environmental education look like? What would we study? Would everyone have to study the same thing..."

"I don't see how they could," I respond. "Modernism maintains the belief in totalizing, colonizing discourse dependent on the assumption that concepts and theories can be 'abstracted from their paradigm setting and applied elsewhere' (Cheney, p. 120). A post-modern education would have to embrace some expression that the 'particular, the different are what's important, not the universal and the general' (Hutcheon, 1991, p. 18)."

"But how could I encourage change in particular, local situations without some kind of general curriculum?" Will asks.

"Why not begin in your school setting?" I ask. "You're returning back to your classroom next year, right?"

"Yes, I only have a one year leave of absence."

"Suppose you were to infuse your Biology or Chemistry class, or both, with an environmental perspective? Instead of proposing a new curriculum, which seems to me fractionates our concerns about the environment further, why not research what you can develop in your own educational setting?"

"That research would have to involve my students," Will suggests.

"Absolutely," I agree. "You might wish to involve some fellow teachers in your research, perhaps a university professor."

"What would we research?"

"You mentioned earlier that a post-modern view of the environment would involve learning to listen to the narrative voice of wilderness. That suggests a provocative question: What would be the effect of a child's conception of the environment if that child learned to listen to the voice of wilderness?"

"Of course," muses Will, "the problem is, what is wilderness?"

"A key question," I add.

Will rises to leave. "You've given me a lot to think about," he says. "My view on teaching and environmental issues is totally different since I came to study at the university. It hasn't always been easy to have your head busted,[1] but all in all its been worth it. I think I'm going to drastically change my Thesis proposal, is it O.K. if I run it by you when I have a draft?

"Any time, Will," I call back. "You are always welcome."

Will goes to leave, but before he does he turns at the door and and says, "You know, I won't be returning to my school the same person. I've seen a bigger view of education and after today I think I can see where I can make a difference in environmental education. I wish all teachers could have a chance to study for a year!"

"But its a two way street, Will," I tell him. "Before meeting you I was only marginally interested in environmental education. The books and readings you have sent my way have changed my life, too. I can no longer look at development and the so-called wilderness the same after our many conversations."

"That's good to know," he tells me. "Conversation is important, eh?"

"I believe that through conversation change may begin. Which is why I think you need to form a research partnership with your students and perhaps some of the teachers in your school."

"Interesting ideas, Dave. I'll have to think on that further. I'll see you later."

I call out good-bye as Will leaves. He'll be back with more questions as he finds his way and I know our conversations will enrich us both. His experience, and the experience of all our graduate students, encourages all of us to reflect on how schooling might be different. Their studies open a vista previously unknown to them, or provides a language to confirm their experiences and hunches about education. In their growing critique of the discourse of education these experienced voices reflect on their local situations and often dis-cover active points of resistance in power and thus opportunities for change. Their vision for change is fundamentally practical; from their experience and their studies many graduate students work within the possible, choosing action-research projects that focus on changing particular situations. Over a year, or two, or more of graduate study students find such a vision of hope and realize anew their desire to make a difference in the world is possible.

---

[1] A common idiom used by our graduate students to describe the effects of their study of curriculum.

What happens to these teachers when they return to the classroom? Do they lose their vision as their lives as teacher become increasingly intensified (Apple, 1988, p. 41)? Suppose teachers were given Sabbaticals for study. What effect would these "time-outs" for reflection have on education? How can teachers take a more active role in educational research? Will's visits always seem to leave me with many questions. Why do we assume a centralized, single program of studies is best in a province or a nation? Why not local centres of curriculum development where teachers, parents, and students work together in choosing the content and approach of the curriculum? Should teachers be given total control over curriculum development? What is the role of professors of education in helping their colleagues teaching children find ways to change schooling? Should professors of education spend more time in schools? Would a partnership of experienced teachers with professors of education provide for a better education for undergraduate students of education? How can professors of education help teachers capture visions for how else schooling might be, visions that are not defined and constrained by the power of the existing discourse?

The Third Book: Nietzsche's Challenge

It's getting late. I decide to grab a cup of coffee from the Faculty lounge and return to my office to tidy up before travelling home. As I come to my door I re-read the quote by Nietzsche (1885/1969) I have posted:

> Why was I so frightened in my dream that I awoke? Did not a child carrying a mirror come to me? "O Zarathustra," the child said to me, "look at yourself in the mirror!" But when I looked in the mirror I cried out and my heart was shaken. (p. 107)

I walk into my office pondering the words of Zarathustra and suddenly remember the third book I had brought along on my journey in the narrative of my dissertation was also by Nietzsche: On Genealogy of Morals (1887/1967). I glance over to my desk at the unfinished narratives and sigh. Will I ever complete this story? I pick up my pen, transported once again to the barren wasteland and the chasm that has become my focal point for most of my final chapter.

The late afternoon sunlight was warm and deep shadows crossed the plain when I turned into my tent to retrieve the final book I had brought on my journey. I found Nietzsche often quite cryptic and wondered why I had brought this particular work along with me. The text was still fairly new, a testimony to how little I had explored Nietzsche's discussion of morals. I glanced at the first few pages and began to read.

Nietzsche writes with a deep, personal, humorous style I find inviting. In the preface to On Genealogy of Morals, Nietzsche describes the agony of his journey to understand morals: "I saw the *great* danger to mankind [sic], its sublimest enticement and seduction-- but to what? to nothingness?-- it was precisely here that I saw the beginning of the end, the dead stop, a retrospective weariness, the will turning *against* life" (p. 19, Nietzsche's emphasis). His description of the end of his inquiry reflected my discovery of the chasm of modernity in my search for change. I, too, had come to feel the dead stop Nietzsche describes. Nietzsche continues in his preface to share how asking questions, in his case questions about the value of morals, leads to new demands that open up understanding. He tells us that whoever

> *learns* how to ask questions here will experience what I experienced-- a tremendous new prospect opens up for him, a new possibility comes over him like a vertigo, every kind of mistrust, suspicion, fear leaps up, his belief in morality, in all morality falters-- finally a new demand becomes audible. Let us articulate this *new demand*. We need a critique of moral values. (p. 20, emphasis his)

I marked my page and stepped out of the tent, eager to look once more at the chasm before nightfall. It was not yet twilight, but deep shadows already obscured the place where I had once seen the visions.

The chasm no longer frightened me, or even depressed me now that I knew both its origin and purpose. As the day came to an end I pondered the same question that I began the day with: The future. What should I do? How should I live? Now what? Nietzsche cites *cheerfulness* as "the reward of a long, brave, industrious, and subterranean seriousness" (p. 21). Certainly I had been serious for too long! Long days agonizing by the chasm had worn on me, I could feel it.

Cheerfulness seemed to me a very odd consequence to my labours, but Nietzsche assures us that it is possible to reach this condition. When we do, he explains, we will be able to "say with all our hearts, 'Onwards! our old morality is too part *of the comedy!'* " (p. 21-22, emphasis his).

What comedy? There was nothing comic about the Quest others and I had taken. What was all our efforts destined to discover? Simply that all the roads out of the kingdom eventually lead to a chasm; a deep, uncrossable abyss of our own making. Our situation was not funny or even vaguely amusing. What was Nietzsche talking about?

I sat beside the abyss and glanced through Nietzsche's discussion of the genealogy of morals. In his first essay he argues that the concept of good and evil are not transcendent states of existence, but categories of behaviour defined by "'the good' themselves, that is to say, the noble, powerful, high-stationed and high-minded, who felt and established themselves and their actions as good" (p. 26). In his next essay Nietzsche makes a similar claim about responsibility, suggesting an origin in the relation between creditor and debtor. Then a passage in this essay about punishment captured my attention. Instead of elaborating a genealogy of the purpose of punishment, Nietzsche advances the ideas that

> the cause of the origin of a thing and its eventual utility, its actual employment and place in a system of purposes, lie worlds apart; whatever exists, having somehow come into being, is again reinterpreted to new ends, taken over, transformed and redirected by some power superior to it; all events in the organic world are a subduing, a *becoming master*. (p. 77, Nietzsche's emphasis.)

Nietzsche then identifies what this becoming master is: "In all events a will to power is operating" (p. 78). On summer vacation in 1953, Foucault was to read Nietzsche's words for the first time, and his life work was to forever travel in a new direction, inspired by Nietzsche's insight of power (Eribon, 1991). In his essay, Nietzsche, Genealogy, History Foucault (1971/1984d) applies Nietzsche's notion of a will to power to include a critique of a "rancorous, creative, destructive will to knowledge" (Megill, 1985, p. 238) that was expressed by example in The History of Sexuality, Part 1 and other major works. By extending Nietzsche's will to power to include a will to knowledge, Foucault was able to formulate and extend the type of critique first articulated in Nietzsche's Genealogy of Morals to "matters of institutions, politics, and knowledge-production" (Deluze, 1986/1988, p. x). In an interview Foucault (1973/1989) admits his entire project was greatly influenced by Nietzsche's The Birth of Tragedy and The Genealogy of Morals. When asked what he found interesting in these two works by Nietzsche, Foucault replied: "What I liked in Nietzsche is the attempt to bring up for discussion again the fundamental concepts of knowledge, of morals, and of metaphysics" (p. 77). Deluze (1986/1988) argues that Foucault's work is profoundly Nietzschean in the way Foucault calls to question again knowledge, morals, and metaphysics through an exploration of power that develops into three major themes:

> 1. Power is not necessarily repressive.
> 2. It is practiced before it is possessed.
> 3. It passes through the hands of the mastered no less than through the hands of the masters. (p. 71)

Deluze concludes that Foucault, standing on the shoulders of Nietzsche's project, presents a question for a modern generation: "We should not ask: 'What is power and where does it come from?' but 'How is it practiced?'" (Deluze, 1986/1988, p. 71) Foucault was not interested in a hermeneutic of power, instead Foucault chose to ask how power works to define the institutions and knowledge-forms we take for granted. Foucault's project is therefore a fundamentally practical and hopeful extension of Nietzsche's critique (Fink-Eitel, 1992), a trachealizing of the violence of Ge-stell, so that, once our enframing is wrestled and laid bare, we can find ways to fight against our modern situation (Foucault, quoted in Rabinow, 1984a).

Foucault's oeuvre presents a challenge to modernity, an invitation built on the work of Heidegger and Nietzsche to fight against the will to power and the will to knowledge that animates the Great Conversation. Yes, we are trapped in a Kingdom, but the King is no longer alive, what remains is a vast nexus of power/knowledge relations, mobile and effective; knowing this we are already able to fight against the totalizing, defining effects of power. It is perhaps in this fight, located through the strategic encouragement of points of resistance in the Kingdom, where change may be possible. Then I realized that if we can change the Kingdom then perhaps the conditions that have led to the dis-ease of the children will also change, and our children will no longer disappear. I felt giddy with hope, charged and excited by possibility.

I recollected conversations with my students I had enjoyed back in the Kingdom. Those entering the priesthood would be one location for working to change the Kingdom. I thought of Desireé and her peers, enthusiastic and energetic individuals that provide a locus for change by encouraging them to find and keep voices of critique. I thought of those already in the priesthood, Will and other experienced voices I knew. During retreats or timely Sabbaticals from their duties or through the opening of spaces for reflection perhaps these voices could also find ways to change the Kingdom from within. With Desireé or Will it was really a matter of designing the correct programs for these individuals, of giving these voices insight into how power/knowledge is expressed in the Kingdom, of providing a system of analysis...

My thinking was suddenly interrupted by a strange sound moving towards me across the abyss. I could not recognize the sound at first, and it was already becoming too dark to see if I could find the source of the sound. Then the sound reached me with perfect clarity: It was laughter! A deep, full laugh, full of fun and mischief, a totally infectious laughter that left me chuckling, too. I laughed because I knew that my plans for turning Foucault's work into systematic analysis, despite my honourable intentions, was simply the voice of modernity, *my* voice, my continuation in the Great Conversation. I laughed because, well, it struck me as humorous that after such a long journey I could slip so easily into the ways of the Kingdom. I could see now what Nietzsche meant by the Comedy: it was life, our continual struggle to Being against those forces that define our being in every act, thought, and word. Our situation was not hopeless, Foucault has taught us this, but our task in the face of Ge-stell is not easy and never will be easy. Standing at the edge of the chasm, I knew that the challenge ahead was to remain constantly in a state of critique, but critique tempered with cheerfulness that comes from the realization that in the enormity of the task of change one simply has to laugh. I had no particular strategy for change in the Kingdom, I could give no workshops on change, no maps can be written, there would be no books on steps to transform a curriculum-discourse. All I had were questions and a suspicion that hope for change in the Kingdom is located in developing conversations of critique within the lives of the experienced and beginning voices I met as well as with the voices without a voice that are hidden on the margins of a curriculum-discourse. What these conversations might be and where they may lead I simply could not say. In fact, I had no guarantees at all these conversations were even possible, that change was even possible, *but I could try*. I burst out laughing and a deep cheerfulness entered my being. I realized that day, facing an abyss that I unknowingly had helped to build and maintain, that I could try, that action was possible, that hope was not futile. The chasm I lived beside became that day more than a reflection of my modern situation, *but a challenge to return to the Kingdom and critique of what is so that what might be may become possible.*

Perhaps it was the setting Sun, but as I glanced across the chasm it seemed as if the vast expanse before me was no longer present, an illusion that vanished before my eyes presenting instead a featureless plain where once an abyss had been. I turned around and in the lengthening twilight, the only feature I could make out was the dim outline of the Lonely Mountains that encircle the Kingdom. I knew I must head back. Anxious to be underway before nightfall, I quickly broke camp, packed and set out towards the mountains.

As I marched with determination across the rocky landscape I never once turned to see if the abyss was simply an illusion. It did not matter to me any more. What entered my soul was a cheerful resolve to find my way back to the Kingdom. The last rays of the Sun touched the peaks of the Lonely Mountains, presenting a pink beacon to guide my way. In no time at all I came to the snowy expanse on the plain and began the steady trip back. I grimly noted the wind was still against me and I braced myself for a long, difficult trip back to the forest in the growing darkness. After hours of dismal walking in darkness, a dark shape began to loom before me and I knew I had found the forest at the foot of the Lonely Mountains. Far off to my right was a point of light and I made my way steadily in that direction. It was a campfire. Hungry, tired, and more than a little cold, I walked towards the comforting campfire eager for company after my long sojourn at the edge of the Kingdom.

(The Third Interruption: Considering The Voice of Children)

As I approached the light of the campfire I was surprised to see a group of children! There was about twenty or so, ranging in age from the very young to older children that would be ready to leave the cathedral. I stopped and listened. The younger children were intent on keeping the fire going, the older children were discussing their experiences at the Cathedral. I could just make out what they were saying.[1]

One young woman, Sally,[2] thought her studies of chemistry were not relevant at all. When asked why, she responded, "I guess I'm just not mathematical. I like things that pertain more to everyday life and things I can relate to more." Everyone laughs around the campfire. She continued, "I just don't find it particularily interesting to learn about cyclohexanes and things like that. It just doesn't seem very relevant to me because I don't really come upon it or anything at any point in my life."

One of her friends disagreed, "I think it's important just at least to get acquainted with it even if you may not remember any of it in the future."

Another chimed in, "But not physics! It could go!" There was general agreement.

A young man named Dave adds, "Physics isn't very well set up. You have textbooks and what they do in the textbooks is physics and history and how they brought these formulas...they don't spend too much time on how these formulas work and how to derive them."

Naomi jumped in at this point, "Yeah, it's just a there kinda thing, they really don't make sense out of it. It's hard..."

Ernest interrupted her, "It's not hard, it's boring!"

"Like Biology," proposed another young woman.

Her friends did not agree, "I thought it was good!" Ellen told the group.

Ernest added, "The way they brought up issues like the environment, eugenics, and stuff.."

The young man next to him had a different experience. He commented that, "If we had one disappointment in our curriculum that would be the lack of things that touch people as a whole, like the environment, health concerns, we just vaguely touched on the little diseases here and there." Students seemed to agree with this sentiment.

The conversation then shifted.

Christine interjected a concern, "It kinda bothers me," She said, "that you need two sciences to get into any real thing" after you leave the Cathedral. She added, "for some people who can't do sciences, they can't do chemistry or physics, then they're out of it!"

---

[1] The following comments are verbatim comments from children I interviewed as part of a research paper. For a description of the research methodology and findings see Blades, 1992a.

[2] Names of students participating in the interviews have been changed to protect the anonymity of the students. In most cases, the students chose their own pseudonyms.

Cheryl said that she was interested in the Priesthood, so she had to take all three sciences, but she adds, "Not that I wanted to, but I had to." Her friends were sympathetic.

Karen suggested that it would be a lot easier if they had a general science course and students were able to specialize if they chose to once they left the Cathedral. Everyone thought this was a good idea and the discussion turned once more to the type of subjects they would like to study in this new program.

I was shocked by their conversation, absolutely transfixed by what the students were saying. Before beginning my studies to be a Scholar I had served as a Priest, teaching children sciences in the Cathedral. I always assumed that generally my students at least enjoyed their classes and the topics they were studying. Certainly *I* found organic chemistry interesting! And who could doubt the value of knowing chemistry and physics? Yet these students seem to find their high school science boring and not relevant to their life. I was quite surprised at the high level of sophistication and insight these students demonstrated in their choices of what they would like to study. In general students wished for courses of study in science that were more aligned with the everyday science needs of consumers. A greater emphasis on first aid and disease, more studies in environmental science, household chemistry, and an understanding of science issues in the news would form the core of their studies (Blades, 1992a). The students also felt a well rounded science program would include topics in astronomy, modern physics, and the history and philosophy of science. They weren't afraid of difficult topics, such as black holes, quantum physics, or complex genetics, what these students wanted was courses relevant to them now and in their future, courses that involve "dynamic teaching from well-qualified teachers who develop science courses from the history and philosophy of science using an investigative approach" (p. 15). Sadly, they concluded that the students following them will only dream of such an experience.

Questions formed in my thinking as I listened to the concerned wisdom shared by these students. I had been involved in several curriculum design committees, yet, now that I thought of if, it was an odd omission that students were never involved in committee discussions. Why are the voices of children excluded from program decisions? Is this exclusion a deliberate function of the science education curriculum-discourse? Nietzsche first introduced the concept of exclusion as a strategic effect of power in The Genealogy of Morals, and Foucault certainly extended Nietzsche's insight by demonstrating how discourse marginalizes individuals. Concerning students, Foucault (1971/1989a) observed that the student is caught

> inside a circuit which possesses a dual function. First a function of exclusion. The student is put outside society, on a campus. Furthermore, he [sic] is excluded while being transmitted a knowledge traditional in nature, obsolete, "academic" and not directly tied to the needs and problems of today. (p. 65)

As I watched these students engage in their serious reflection, I marvelled how the group most marginalized by the Cathedral was the exact group the Cathedral was supposed to be serving: our students. During my travels with the team I found the exclusion of voices in a discourse a specific procedure of power to define a discourse. This must mean that the "deliberate exclusion of these voices from discourses on curriculum change is not accidental but a function of present discourse practices" (Blades, 1992a, p. 16). I thought about how easy it was to assume children "had little to contribute to a conversation on curriculum, how simple to exclude them with a word, an act, an approach" (Blades, 1992b, p. 19).

It need not be so. Ungerleider (1986) and Lock (1984) found students willing and able to be involved in curriculum decision-making. The voice of those "on the front lines of education" (Townsend, 1990, p. 4) should provide valuable insight into the needs and potentials for learning in classrooms within the Cathedral of our Kingdom. Townsend uses a medical metaphor to summarize the value of student voices in curriculum decisions. He suggests that when it comes to changing education, "who can tell the doctor where it hurts better than the patient her or himself?" (p. 4). Indeed, Foucault (1971/1989a) takes this one step further in his suggestion that the entire Cathedral system "can be put into question by the students themselves" (p. 64).

I decided to leave the students and stepped back into the surrounding trees, only to make a very loud cracking sound as I walked on a fallen tree branch. Immediately one of the students called out, "Who's there?" Some started to point in my direction and, not wanting to worry them, I decided to step into their light and conversation. I explained my situation and where I was headed. They were very accepting and invited me to join them. We talked almost until the morning light; mostly I simply listened to the deep experienced insights of these students about to leave the Cathedral. When I finally made camp and crawled into my sleeping bag, questions haunted my weariness and I found it hard to fall asleep. Farrell (1985) observes that the cyclical nature of attempts at educational reform has "little to do with how adolescents perceive or value schooling" (p. 22). What would be the effect on the curriculum-discourse of science education if the voices of students were included? How might the integrity of student voices be safeguarded against the defining activity of a curriculum-discourse through the procedures of exclusion or consultation? We have a lot of students enroled in the study at the Cathedral- do these students present a location of resistance in the science education curriculum-discourse? How might this resistance be encouraged? Could students help generate conversations of critique Foucault suggests are avenues of hope for change in the Ge-stell of modernity? Could students play an active role in the kind of action-research I discussed with my graduate student Will? I remember falling asleep thinking that I have discovered many questions in my travels, but few answers.

Towards a Post-Modern Science Education Curriculum-Discourse

> To say that one can never be 'outside' power does not mean that one is trapped and condemned to defeat no matter what.
> Foucault (1977/1980), Power/Knowledge, p. 142.

I could tell it was very late when I woke, for the Sun was already high in the sky. I had slept more soundly the previous night than at any time during my travels and I woke feeling rested and eager to break camp and get on my way. The students had long since cleared away any trace of their camp and for a moment I wondered if my encounter with them was a vision.

It was a beautiful day. I dressed quickly and broke camp, eager to be on my way. Beside my camping site was a clear pathway leading deep into the forest. I set out on this path wondering how long it would take me to find my way through the mountains.

The route was not familiar to me, but I was clearly rising in altitude and travelling directly into the range of mountains that encircle the Kingdom. At a height of perhaps a thousand meters the path turned sharply to the left, providing a last vista of the flank of the Lonely Mountains and the plain below. I could not see the chasm. I could just make out the glacier shaped like an angel on the mountains ahead and I judged that I was travelling a little south of my first route through the mountains.

I decided this was a good spot to rest and have what was now lunch. The encounter with the students came to me and I reviewed their questions. Questions. It was a single question that started me on my journey so many years ago. I laughed out loud at the audacity of Al's question, "Sir, why are we learning this crap?" Why, indeed. Good question, Al. But there are others. My conversations with Foucault, Heidegger and Nietzsche initiated a critique of the procedures of power in a particular science education curriculum-discourse. This critique then moved to consider the practical concerns of change as my conversations widen to include students, such as Desireé, Will, and those I met in the forest. At every moment, however, I knew our conversation of critique would be in danger of an enticing subduction into the comfortable defining of the Great Conversation of the Kingdom.

I finished my lunch, picked up my back pack and headed deeper into the forest and mountain pass, sorry to leave the beauty of the sunlight on the mountain glacier behind. How would I be able to work against the power of modernity? How might my conversation of critique remain not comfortable? As I hiked the impression of an angel reminded me of the account of Jacob wrestling with an angel that opened the fourth chapter of my dissertation. I recalled the final verse of the passage: "Your name shall no longer be called Jacob, but Israel; for you have striven with God and with men and have prevailed" (Creation House, 1984, NASB, p. 50: Genesis 32: 29). Something did not make sense in that verse. Did Jacob not wrestle an angel, not "with men"? The Hebrew word angel (Yish) also means a person, thus my midrash that on that key night in the transformation of Jacob the real adversary Jacob faced was himself. Why then does the giving of a new name to Jacob refer to Jacob wrestling "with men"? The Hebrew word for men in the text is *A'Nashim*[1], literally the breathed into ones, or people in general. Jacob's blessing came after he had struggled not only with himself, the Bible suggests, but also with others.

As I hiked I thought about the meaning of this subtle change in wording in the Biblical passage. Jacob became someone else, Israel, but this change was not something he could do completely alone. He needed to wrestle, with God, with himself, and with others to complete his transformation. It is the act of wrestling that brings a new name, a new being and, in Jacob's case, the courage to cross the river and claim his inheritance.

---

[1] אֲנָשִׁים, from the text found in Sinai Publishing (1984), p. 73.

I could relate to Jacob. In my life the chasm was my angel, I wrestled at the edge of the Kingdom with my modernity, my contribution to the Great Conversation, my struggle was a trachealization of the procedures of power in a curriculum-discourse that led to the trachealization of a discourse of being. That dis-covering of being was not possible without a wide range of conversations, with Foucault, Heidegger and Nietzsche, with professors and students in my department at the University of Alberta, and with those directly involved in the science education curriculum-discourse. My journey back to the Kingdom would not be possible without the call to continue engaging these voices and beginning teachers, experienced teachers, and students as we wrestle together the discourse that seeks to define who may speak and what may be said in science education. I started to whistle a tune, a song I had heard once back in the Kingdom. As I walked through the forest that afternoon I realized I was not the same person that left the team at the crossroads long ago. Cheerfulness had entered my being and I had the courage to enter the Kingdom. I knew the task of change involves questions of being, but that change in being *is* possible. That afternoon I made my last research entry in my journal:

> I sense a distancing from where I once was. The whole event has been moving, jarring, stretching and transformational. I wish I could express the deep contentment I feel now. I'm relaxed, happy, and looking forward. (Journal entry, January 4, 1992)

The path I had taken led to a crossroads. I recognized the location. Ahead the path served to traverse the mountain range. To my left, the familiar route the children had taken Foucault and me on our journey out of the forest to the plain below. To my right I could just see the chalet that offered such hospitality to us on our journey and a wider pathway leading through the mountains. This path led to the main roads of the Kingdom. I knew I did not have to go back but I caught an image of the parents who welcomed us to their chalet. They could not hide their fear for their children, a fear we all held as children continued to disappear across the land. No, I did not have to go back but I knew I would. I knew I *could* go back because *I was no longer one of the King's subjects.* Foucault had taught me that the King is no longer alive and my experience at the abyss taught me that I no longer have to live as if the King still existed. Aware of some of the procedures of power, modernity had a less defining grip on my being and I knew change was still possible. I chose the right path.

There was no one at home at the chalet, so I continued on my trip. The short pass through two large mountains was still well marked by cairns and soon the trail led to hills that slowly descended to the valley of the Kingdom. At the end of the pass the forest gave way to a spectacular view of the valley below. There, waiting for me, was Foucault and two companions I immediately recognized as Heidegger and Nietzsche.

It was so good to see Foucault again and I was glad to get to know the two philosophers that influenced Foucault's work. We spent the afternoon chatting in the cheerful warm of the afternoon sun. This was not serious talking, but the casual joking and spontaneous changes in topics of friends parted too long. We talked about everything and anything, from my experiences at the chasm to the latest popular recording in the Kingdom.

I was interested to find out that the latest recording by the Canadian poet Leonard Cohen had become popular in the Kingdom. Although I had been a long time fan of Cohen's work, his poems set to music had never captured a great deal of public attention. My companions assured me this newest release was quite different. I examined a recording they had brought and read the opening lines of the title song, The Future (Cohen, 1992):

> Give me back my broken night
> my secret room, my secret life
> it's lonely here,
> there's no one left to torture.

From this dark and deeply sarcastic introduction Cohen continues later:

> Give me back the Berlin wall
> give me Stalin and St. Paul
> I've seen the future, brother:
> It is murder.

Cohen then paints an apocalyptic vision in a haunting chorus:

Things are going to slide in all directions
Won't be nothing
Nothing you can measure anymore
The blizzard of the world
has crossed the threshold
and it has overturned
the order of the soul
When they said REPENT
I wonder what they meant

I looked to my companions, shocked by the words. Other songs on the album held a similar nihilistic edge, as Cohen sarcastically suggests we're all waiting for a miracle that may never come, such as democracy to the U.S.A., while the bar keeper of the world is shouting, "Closing time!" I wondered if the popularity of the songs was partially due to their dark message. Perhaps the citizens of the Kingdom truly felt the future was murder. I shivered, even though warm. Was the situation really as desperate as Cohen portrayed in his album? I thought of dire predictions of environmentalists that we have only a few decades to turn around the present rate to planetary degradation. The rise of STS science education may be an important response to this new crisis, but science education curriculum-discourse is still enframed by technicality. I glanced at Foucault and recalled that children were still disappearing. Perhaps Cohen's words were prophetic after all.

In the midst of the sarcastic nihilism of Cohen's latest work one poem, The Anthem, stands alone in its vision of hope and promise:

The birds they sang
at the break of day
Start again
I heard them say.
Don't dwell on what
has passed away
or what is yet to be.

Ring the bells that still can ring.
Forget your perfect offering.
There is a crack in everything.
That's how the light gets in.

I smiled and thanked Cohen in my heart for the timely reminder that in the midst of the Great Conversation there are bells that can still ring. The interrupting voice of children, beginning and experienced teachers, philosophers and poets still call out to be heard. We can help the clear chime of these voices to sound throughout a curriculum-discourse by opening the spaces where discourse finds resistance.

To find these spaces we must forget our perfect offerings. There is no ideal science education curriculum-discourse, no generalizable formula for changing a discourse, no method that works in every situation. What happened in Alberta to Science 10-20-30 is the relentless defining of Ge-stell, the effects of an anonymous Great Conversation that includes us all.

But Cohen proposes that there is a crack in everything, including power. Where power is exercised, so too resistance can be found. By dis-covering the procedures of power in a curriculum-discourse we already are aware of how power operates and thus can enter into a life of critique. In the science education curriculum-discourse power defined who may speak and what could be said, but in its exercise also revealed critical voices on the margins of the discourse and penetrating questions that were not asked. The procedures of power may change from discourse to discourse, even within the same discourse over time, but because of Foucault's example we can say now that we are on to power: It has lost anonymity.

By a constant trachealization of power where it exists the cracks in Ge-stell appear, and that's how the light gets in. Thus illuminated, we can begin to see our way out of the darkness, from the modern to the post-modern. Change *is still possible*, though a night of our own making is falling there is still time.

At the beginning of Chapter 4 Jacob taught us that change is difficult, a constant wrestling that may involve injury but also promises great blessing. Wrestling is hard work, our opponent shifts and changes so much that the match promises to be a difficult one. As the text hints, we need to include others in the match, the contest is ours to share and together we may prevail.

I glanced at my companions and then stood up. Before me was the great valley of the Kingdom, quiet as twilight approached. At the chasm I had longed for the dis-comfort that comes from being with others and now the invitation to find this dis-comfort was only a short trip away. I was unable to find a cure for the disappearing children because I could not find a route out of the Kingdom, trapped by the chasm we all helped to create and maintain. My despair at the abyss led me to consider how else the Quest could be, and I discovered the importance of questions. What quest was I on now? I thought of the conversations of critique possible in the location of the lives of beginning and experienced teachers and students and through listening to the interrupting voices of children. I no longer believed a route out of the Kingdom was possible, but I now held the conviction we can change the Kingdom itself. Perhaps if the conditions that allow the Kingdom to exist were to change, that which causes our children to disappear may also change. I did not know, but it was worth a try. I looked at the valley below. Like Jacob, I reached the point where I was willing to cross the border, to find the blessing. I can not make this blessing on my own, however. Foucault, Heidegger and Nietzsche will travel with me and I know they have much, much more to teach. But to find the blessing, *our* blessing others must join me in the struggle to encourage conversations of critique towards a post-modern science education curriculum-discourse. I turn to you who have so patiently lived with/in the conversation of this text, and to whom I have shared my discoveries and journey. There is much to do and the children are waiting. I'm ready now to travel back into the Kingdom and I extend an invitation that we travel together: Let's go.

POSTSCRIPT:
CONTRAINDICATIONS IN WRITING A POST-MODERN DISCOURSE AND SOME THOUGHTS ON A POST-MODERN SCIENCE EDUCATION

Writing a Post-Modern Discourse

Those readers interested in engaging in the trachealization of the procedures of power in a local curriculum-discourse, with subsequent reporting of their research, may find the method I used to write my dissertation useful. Of course, I share my method with the a priori understanding that what is offered is not a generalizable technique, but an example to consider before embarking on a research journey similar to the one that I have taken.

Early in my writing I recognized that a critique of modernity involves a struggle to break from the frames (Ge-stell) that defines who may speak and what may be said (Blades, 1990). This struggle requires, I believe, a concerted effort to avoid presenting a metanarrative or any kind of global theorizing in writing, since post-modernity adopts an attitude of incredulity to the value of metanarratives or such theorizing (Lyotard, 1979/1984). It is, however, one thing to discuss what post-modern writing should involve, quite another to actually engage in this writing! Prior to my arrival at the University of Alberta, all my academic writing was categorically traditional and I was used to thinking in thoroughly modernistic patterns. Although I continued to write and think modernly during my first few years studying at the University of Alberta, I was consistently challenged and encouraged in my courses and readings to critically examine technical-rational approaches to curriculum change and to explore other ways of understanding curriculum change. My studies ranged from investigating the application of hermeneutics in curriculum research to social critical theory, but eventually I came to focus on the post-modern writings of Foucault.

Why Foucault? My first discovery of Foucault's writings was, as I have shared in my dissertation, purely accidental. As I became a participant-observer in the attempts to change secondary school science education in Alberta I came to realize Foucault's work The History of Sexuality, Part 1 (1976/1990) provided deep and profound insight into why the original Science 10-20-30 initiative failed. I naturally was led into other writings by Foucault and biographies of Foucault's life and, slowly, a research project informed by Foucault's concept of power began to form.

I discovered from this that one does not have to look far to find a curriculum-discourse worthy of research. The destining of modernity is pervasive and extensive, there are avenues to dis-cover the procedures of power operating with(in) us nearby. What I was unprepared for at the initial stages of my research was how my re-searching would turn on me to consider my own life. This was unexpected and somewhat traumatic. I don't believe there is a way out of this in post-modern writing. The type of questioning post-modernism invokes eventually seems to turn to questions of being, *ones* being. Heidegger predicted this, of course, but I found reading about it one thing, experiencing it another. The first contraindication in the attempt to write a post-modern discourse is a warning that such writing will involve considerable struggle that will be uncomfortable. The very assumptions that have guided ones life become unexpectedly opened, laid bare and wrestled in the research act. This, I found, can be quite unsettling and the readers interested in writing a post-modern discourse should realize from the beginning they may not like what they discover. I found the Biblical narrative of Jacob and the angel quite informative. To be sure, Jacob found change is possible and he was able to claim his blessing, but Jacob also was injured from the struggle and walked with a limp, according to tradition, for the rest of his life. One must, I believe, be prepared for the consequences before engaging in post-modern writing.

A second contraindication in writing post-modernly is the amount of time and dedication such a project demands. In my experience, I found that as I wrote I slipped easily and comfortably, and often without realization, into presenting a theory of curriculum change. In my original outline for this dissertation I began with a discussion of the failure of technical-rational approaches to curriculum change and then proceeded to argue that a Foucauldian analysis of power in a curriculum-discourse would ensure change. In other words, I *used* a Foucauldian analysis as a technique to find strategies for change, a complete structuralistic adaptation of Foucault's work. Nor was I alone in this posture; most writers in education that cite Foucault's works have adapted, re-interpreted, and I believe fundamentally misunderstood, Foucault's concept of power. This is what we should expect from the destining of modernity and I confess that initially I too fell into this entrapment in my writing.

The three books I emphasize in Chapter 5 helped me realize the direction my original dissertation was heading. Nietzsche, in particular, caused me to question if a will to power was operating in my writing and this reflection helped me realize that what I was originally writing was contributing to modernity, not struggling against it. I began to reconsider the structure of my dissertation, thus beginning a long struggle to find a post-modern way to write. I finally found a method that worked for me. First, I would write a chapter of the dissertation traditionally, recognizing that what I was producing was likely very modernistic. Then I critically turned on the discourse I produced and explored how else I might write without presenting a theory of curriculum change. I found it impossible to take this post-modern turn without, oddly, a modernistic context from which to move! The fact that most of us have been successful in learning how to contribute in the Great Conversation means that for many post-modern writing will involve first writing in a familiar, modernistic way and then deconstructing this writing and then re-constructing the text post-modernly. In my experience, this meant writing my dissertation *twice*, first from a traditional voice followed by a critical deconstruction leading eventually to susequent writing as I attempted to give the text a post-modern turn. This was very, very time consuming and at least tripled the effort and time commitment normally involved in writing.

Writing a post-modern discourse is also very difficult since there are so few examples of post-modern writing available. In the field of education I was able to find a few examples of post-modern writing in the work of Daignault (1992), Jagodzinski (1989) and, in my opinion, in the philosophical works of Derrida, Nietzsche and the later writings of Foucault. These writings provided inspiration that post-modern writing is possible. For example, I searched carefully through Discipline and Punishment by Foucault (1975/1979) and was unable to discern any theory of prisons or justice systems, or power for that matter, in this work. Foucault has plenty to say about prisons, justice systems and power, but he is somehow able to do this without slipping into the construction of metanarratives or theorizing. Foucault's literary technique is to share stories that provoke questions in the minds of readers. Post-modern writing in education often uses personal narrative to give the text a post-modern turn. I decided to use both methods in my dissertation by offering a critique of the destining of the Great Conversation by using stories and events, such as the Sputnik launching and rise of concern over planetary degradation, to expose crisis within the conversation while at the same time deconstructing my own involvement in this conversation. By weaving the personal with the global, I tried to engage my readers in a conversation that might consider their involvement in the Great Conversation.

This provoking to question is part, I believe, of initiating a conversation of critique that is a post-modern turn.

To write post-modernly the reader will need, I suspect, to read widely the works of Nietzsche, Heidegger, Foucault, Derrida, Vattimo, Levin, and others mentioned in the dissertation. Those readers unfamiliar with recent movements in continental philosophy may originally find these works quite daunting, I know I did. I encourage readers interested in writing post-modernly to not despair with Heidegger's cryptic style or Nietzsche's sarcastic humour but to find others interested in post-modern writing projects and to enter into conversations over the meanings of recent philosophical works. During my studies at the University of Alberta I found kindred spirits open to discussion about the meaning of these works among faculty, fellow graduate students and neighbours. I also became involved in a study group consisting of faculty and students that met informally to consider post-modern questions about our relation to the other. These meetings were very helpful in the deconstruction of my work and enabled me to find, I hope, a post-modern voice. Anyone considering moving in this direction in their own writing might consider forming a similar research group.

A few words are in order about the structure of my dissertation. I try to avoid throughout any presentation of a meta-theory of curriculum change while speaking, I hope, to major issues about curriculum change in science education. In my first chapter I suggest the rise of STS is a response to the second crisis in science education, but locate the mainstream discourse of curriculum change within the Great Conversation of modernity. Essentially an argument arises in this chapter: given the history of the *first* response to the first crisis in science education and the entrenchment of technicality in educational discourse, why should we expect the *second* response of an STS solution to fare any better than the mega-reforms of the sixties? A focus on this argument in Chapter 1 would have led to a very traditional thesis: The solution to the first crisis in science education was not successful, so here's my solution to the second crisis in science education. To avoid this modernistic presentation, I weave a personal account within the stories presented in Chapter 1, suggesting the extent of the defining of Ge-stell is more extensive than we might originally realize, hinting that the issues surrounding curriculum change are ontological. The dissertation takes, from the opening in Chapter 1, a pedagogical role in demonstrating the extent of our entrapment and the seriousness of our modern situation.

In the second chapter I allow the evolution of Science 10-20-30 to unfold naturally, interweaving a technical-rational interpretation that is laid bare and shown to be barren historically and in application. Through the accounting of attempts at change within a particular curriculum-discourse, Chapter 2 demonstrates in the particular the dilemma presented in the overview of Chapter 1. This particular grounding is important, I believe, in helping to avoid the tendency to develop global theories of curriculum change; all I can speak of is what happened in Alberta and although I find direct parallels exist in many situations, I can avoid the temptation to theorize by keeping my comments focused on a particular example. I encourage any reader interested in writing in curriculum from a post-modern perspective to ground comments in a particular, local example.

Chapter 3 introduces key elements in Foucault's work that are germane to the dissertation. Foucault dealt with many forms of power/knowledge and my gleanings explore the value of his insights to understanding where curriculum comes from and why curriculum is so difficult to change. Chapter 3 presents why Foucault's works are important in educational discourse and how I went about trachealizing the curriculum-discourse in Alberta. The method I used is shared, as I point out, not as a formula but more as confession of my research approach.

The fourth chapter was the most difficult and time consuming to write. Faced with the task of elaborating the procedures of power I dis-covered, I realized that a simple listing and elaboration would be very close to an outright structuralistic interpretation of the events in Alberta. I explored a metaphorical style for this chapter in a paper I presented at a curriculum conference (Blades, 1992b) and this paper was well receieved, giving me the courage to try and develop an extended metaphor, or allegory for my fourth chapter. Writing this allegory was enjoyable, but time consuming since writing a story meant I had to constantly check the narrative to ensure continuity of details. To make sense of the journey a map was needed. This map proved to be revised six times during the constant rewriting of the allegory. Every nuance in the story has meaning and I admit that preparing the symbolism was challenging but very fun. Writing an allegory of the evolution of Science 10-20-30 caused insights into the curriculum-discourse to arise that I had not expected. For example, my arrival at the chasm, so central to Chapter 5, was not in the first draft of my allegory (originally, I simply returned to the Kingdom discouraged). I encourage those considering post-modern writing to read allegories for inspiration (I read More's

Utopia (1516) and Orwell's Animal Farm (1945); these allegories seemed appropriate!) and to try this writing style. I found the use of allegory and metaphor revealed deep insights into the questions I was exploring that may have otherwise remained undiscovered.

The final chapter of my dissertation is an attempt to directly face the issue of curriculum change in science education while avoiding the modernistic trap of developing a theory for how we should proceed. The interruptions presented are personally constructed somewhat metaphorical conversations (for example, note the names chosen) that suggest possible locations where I could encourage conversations of critique while the three books help identify our general ontological situation in curriculum change and where hope may be found. Of course, this hope and the interruptions merge in Chapter 5, suggesting locations for activity in my life as a scholar-teacher in a university setting and not necessarily locations for action others might identify. My chapter ends with the invocation to action that arises from the conversations of critique that still are possible within the relentless defining of the Great Conversation. The metaphor animating this chapter is Jacob's wrestling with an angel, an apt description, in seems to me, of the task we face and the hope for change.

What Might Be the Characteristics of a Post-Modern Science Education?

Of course, I can not directly answer this question without falling into the trap of presenting a theory of a post-modern science education! What I can offer is some tentative thoughts and musings on what might happen if science education curriculum-discourse were to move towards post-modernity and some possible directions for research that flow from these ponderings.

I believe most, if not all, attempts to generate generic science curricula will likely continue the current crisis in science education and that present attempts to develop provincial, national, and international STS curricula are likely doomed to failure. Generic programmes are founded on the concept that a program of studies suitable to all students can be developed. This development rests on the assumption that children and teachers across a region are similar in history and local; that is, these programmes adopt a view of a generic teacher with a generic class. Adopting this posture means resources must by generalized enough to fit all situations and curriculum guides vague enough so that they can be adapted by teachers in a variety of situations. The result is a program of study that is not rooted in the particular situation of schools or the lives of particular groups of students and as such is often not relevant to particular lives and situations. For example, the regions of northern Alberta are considerably different in ecology than in the south and the biological issues of each region may be different, yet students study the same program and approach to ecology regardless of the particulars of their location. Why? A post-modern science education abandons, I believe, all notions of provincial or national curricula in favour of the local and particular, entrusting curriculum development to rest in the hands of teachers and students. Such a radical re-definition of our present situation has, of course, considerable consequences for institutions involved in teacher education, government Ministries of Education, and the social order of Western society in general.

I am constantly surprised by the mythological presentation of the so-called scientific method in school science. Science is, I believe, a fundamental expression of the innate drive in us to explore and make sense of the natural world and often does not proceed in the orderly way presented in school science (Polyani, 1988). Somehow the dynamics of this venture is lost in schools among the mass of facts students accumulate. I don't know what this accumulation of facts is, but it is not science. In fact, many secondary school science courses seem to me to be more an exercise in learning a foreign language than science. The first challenge of educators teaching children science "should be to acquaint students with science as science is actually done" (Bruffee, 1992, p. 20). Of course words are important in this education, but science is something people *do*, like art, and must not be confused with the accumulation of facts that are regurgitated later on tests. A post-modern science education would be, I believe, very active oriented with components of actual scientific inquiry and reporting. I envision students even producing their own scientific journals and direct involvement with the scientific community. If this were to happen students would discover the world is indeed a uni-verse, a single poem that is complex and chaotic (Crowell, 1989). The profound insights of quantum mechanics and the best-kept secrets about the loss of objectivity should be brought into science classrooms to be explored and celebrated. I see in post-modern science education a shift from the facts to dialogue, negotiation and interaction between teachers, students, and scientists; to play with paradox as W. Doll (1992) describes post-modern education. A research project that explores the effect of such a science education on the attitudes of children to science education and their career choices would be very valuable.

A post-modern science education could be founded on the voices of students and their parents. It seems to me that for too long curricula has been designed far from the home. Of course, a single, generic, home does not exist; Canadians live together in a multiplicity of ways. We do live together, however, and children do come from homes. The parents or guardians of these children have vested considerable energy and time in the the lives of these children and deserve input into the content and direction of their child's science education. Certainly more research in the possibilities and potential of involving parents in curriculum content and pedagogy decisions is needed. My research (Blades, 1992a) presents a beginning exploration of the wisdom of the experienced voices of senior secondary school students on curriculum decisions. I was shocked at the consistency among children in their views of their science education experience and opinions of what could be done to improve science education. These voices are absolutely critical, I believe, to change in science education curriculum-discourse; not only because of the informed critique these children bring but also the valuable ideas they have. Certainly this is an important area for future research.

Finally, an update on the situation in Alberta. Within the last six months of the writing of this dissertation I have had conversations with two senior Career Associates with Alberta Education. Both of these Associates informed me that student enrolment in Science 20 and 30 is much lower than anticipated. There is some discussion, rumours at this point, that Science 20 and 30 may become designated as non-academic courses not suitable for university entrance. The future of Science 10 is not clear, but one Career Associate told me that teachers are complaining the program tries to cover far too much material. Apparently some teachers are calling for the Science 10 program to be split into four courses: Biology 10, Chemistry 10, Physics 10 and a non-academic Science 10. I personally doubt this will happen since Science 10 allows the CALM 10 program in Alberta to exist, still the fate of Science 20 and 30 should not surprise us. These latest rumours, and that is still what they are, serve to remind us that the opponent we wrestle is bigger than any individual and if we are to prevail, for the sake of our children and the future of our species, we will need to wrestle modernity together.

BIBLIOGRAPHY

Aiken, H. (1956). The age of ideology. N.Y.: Mentor Books.

Aikenhead, G. & Fleming, R. W. (1975). Science, a way of knowing. Saskatoon: University of Saskatchewan.

Aikenhead, G. (1980). Science in social issues: Implications for teaching. Ottawa: Science Council of Canada.

Aikenhead, G. (1983). Teaching science today, relevant to 2001 A.D. Teacher Education, 23, 58-75.

Aikenhead, G. (1985). Science curricula and preparation for social responsibility. In R. W. Bybee (Ed.) Science, Technology, Society: 1985 yearbook of the National Science Teachers Association (pp. 129-143). Washington, D.C.: National Science Teachers Association.

Aikenhead, G. (1986). Does school science reflect real science? Accelerator, 12 (2), 1-5.

Aikenhead, G. (1991). A missive to the science-technology-society research network. Science-Technology-Society Research Network, 4 (1), 1-16.

Aikenhead, G. (in press). The social contract of science: Implications for teaching science. In G. Aikenhead & J. Solomon (Eds.), STS Education: International perspectives on reform. N.Y.: Teachers College Press.

Alberta Education. (1977a). Curriculum guide for senior high school chemistry. Edmonton: Author.

Alberta Education. (1977b). Curriculum guide for senior high school physics. Edmonton: Author.

Alberta Education. (1984). Biology 10-20-30 curriculum guide. Edmonton: Author.

Alberta Education. (1986a). Instructional program review and development: Policy, guidelines and procedures manual. Edmonton: Author.

Alberta Education. (1986b). Secondary education action plan. Edmonton: Author.

Alberta Education. (1987a). General science subcommittee (10-20-30) terms of reference. Edmonton: Author.

Alberta Education. (1987b). General science 10, 20 30 subcommittee minutes (March 3 & 4, 1987). Edmonton: Author.

Alberta Education. (1987c). General science 10, 20 30 subcommittee minutes (April 8 & 9, 1987). Edmonton: Author.

Alberta Education. (1987d). Essential Concepts, Skills and Attitudes for Grade 12. Edmonton: Author.

Alberta Education. (1987e). Proposed directions for senior high school programs and graduation requirements. Edmonton: Author.

Alberta Education. (1988a). Interim program of studies: Science 10-20-30 (September 7, 1988). Edmonton: Author.

Alberta Education. (1988b). Curriculum design branch three-year plan: 1988-1991. Edmonton: Author.

Alberta Education. (1988c). General science 10, 20 30 subcommittee minutes (January 25, 1987). Edmonton: Author.

Alberta Education. (1988d). General science 10, 20 30 subcommittee minutes (October 27, 1988). Edmonton: Author.

Alberta Education. (1989a). The science programs for Alberta's high school students: A brief report. Edmonton: Author.

Alberta Education. (1989b). Science, technology, society and curriculum. InFocus, February, 1989, p. 5.

Alberta Education. (1989c). Program implementation/support schedules for ECS - Grade 12. Edmonton: Author.

Alberta Education. (1989d). Draft program of studies: Science 10-20-30. Edmonton: Author.

Alberta Education. (1989e). News Release, July 25, 1989. Edmonton: Author.

Alberta Education. (1989f, March 20). Science 10 Textbook, Introductory Chapter: Synopsis of comments- Science 10/20/30 Sub Committee Members/Alberta Education. Edmonton: Author.

Alberta Education. (1990a). News Release, January 26, 1990. Edmonton: Author.

Alberta Education. (1990b). Backgrounder: Directions for senior high science programs- issues and actions. Edmonton: Author.

Alberta Education. (1990c). A guide to curriculum planning in science. Edmonton: Author.

Alberta Education. (1990d). Science 10 Draft Course of Studies, August 31, 1990. Edmonton: Author.

Alberta Education. (1991). Science 10: Discussion Draft Course of Studies. Edmonton: Author.

Alberta Medical Association. (1989). News Release, June 27, 1989. Edmonton: Author.

Alberta Science Education Consultants Council. (1984). Secondary school science in Alberta: A focus to the future. Unpublished manuscript.

Alcoff, L. (1993). Foucault as epistemologist. The Philosophical Forum, 25 (2), 95-123.

American Association for the Advancement of Science. (1989). Science for all Americans: Project 2061. Washington, D.C.: Author.

Andrews, G. E. (1989, July 25). Alberta students won't be able to compete. Calgary Herald, p. A6.

Aoki, Ted T. (1985). Toward curriculum inquiry in a new key. Curriculum Praxis: Occasional Paper Series, No. 2. Edmonton: University of Alberta, Department of Secondary Education.

Aoki, Ted T. (1988). Toward a dialectic between the conceptual world and the lived world: Transcending instrumentalism in curriculum orientation. In W. F. Pinar (Ed.), Contemporary curriculum discourses (pp. 402-416). Scottsdale, Arizona: Grosuch Scarisbrick.

Apple, M. W. (1988). Teachers and texts. N.Y.: Routledge.

Armstrong, G. (1989). Sabotage in schools. The Alberta Science Teacher, 9 (3), 10-13.

Association of Professional Engineers, Geologists, and Geophysicists of Alberta. (1991). The greening of science and technology. PEGG Magazine, 1 (1), 4-6.

Atkin, J. M. (1989). Can educational research keep pace with educational reform? Phi Delta Kappan, 71 (3), 200-205.

Author Group. (1972-1977). Alchem. Edmonton: Karitann.

Ayas, N., Cepni, S., & Akdeniz, A. R. (1993). Development of the Turkish secondary science curriculum. Science Education, 77 (4), 433-440.

Bacon, F. (1942) Essays and New Atlantis (G. Haight, Ed.). N.Y.: Walter J. Black. (Original work published 1597)

Ball, S. J. (1990). Introducing Monsieur Foucault. In S. J. Ball (Ed.), Foucault and Education: Disciplines and Knowledge (pp. 1-8). N. Y.: Routledge.

Beardsley, T. (1992). Teaching real science. Scientific American, 267 (4), 98-108.

Berman, M. (1989). Coming to our senses. N.Y.: Bantam Books.

Bernauer, J. W. (1990). Michel Foucault's force of flight: Towards an ethics for thought. London: Humanities Press International.

Bernie, H. H. (1991). Science in the schools. College of Education Centre for School-Based Programs, Monograph #3. Saskatoon: University of Saskatchewan.

Berreby, D. (1990). The numbers game. Discover, 11 (4), 42-50.

Bexon, S. (1989, October 29). New curriculum threatens fine arts options. Calgary Herald, p. D6.

Birmingham, P. (1989). Local theory. In A. B. Dallery & C. E. Scott (Eds.), The question of the other: Essays in contemporary continental philosophy (pp. 205-212). Albany, N.Y.: State University of New York Press.

Bjerg, J. & Silverbrandt, H. (1980). Roskilde University Centre- a Danish experiment in higher education. Journal of Curriculum Studies, 12 (3), 245-261.

Blackman, W. J. (1989, May 15). Science curriculum change no help to students. Calgary Herald, p. A6.

Blades, D. W. (1986). The effects of an integrated approach to science education on the development of critical thinking abilities of grade ten secondary school students. Unpublished master's thesis, University of Victoria, Victoria, B.C.

Blades, D. W. (1990). The 5th corner: Deconstruction, hope and possibilities for change in science education. Paper presented at the 1990 Bergamo Conference on Curriculum Theory and Classroom Practice, Dayton, Ohio, October 17-20.

Blades, D. W. (1992a). Conversations form the margins: Grade 12 students' perceptions of their senior high school science program and possibilities for change. Alberta Science Education Journal, 25 (1), 8-18.

Blades, D. W. (1992b). Procedures of power in a curriculum-discourse: Conversations from home. Paper presented at the 1992 Bergamo Conference on Curriculum Theory and Classroom Practice, Dayton, Ohio, October 14-18.

Blair, C. (1987). The statement: Foundation of Foucault's historical criticism. Western Journal of Speech Communication, 51 (4), 364-383.

Bollow, O. F. (1987). Crisis and new beginning. (D. Moss & N. Moss, Trans.) Pittsburgh: Duquesne University Press. (Original work published 1966)

Boorstin, D. J. (1983). The discoverers. N.Y.: Random House.

Borgmann, A. (1992). Crossing the postmodern divide. Chicago: University of Chicago Press.

Bowers, C. A. (1980). Ideological continuities in technicism, liberalism, and education. Teachers College Record, 85 (1), 293-321.

Boyne, R. (1990). Foucault and Derrida: The other side of reason. Boston: Unwin Hyman.

Broughton, J. M. & Zahaykevich, M. K. (1982). The peace movement threat. Teachers College Record, 84 (1), 152-173.

Brouwer, W. (1985). Rethinking the rationality of science. Edmonton, Alberta: Department of Secondary Education, University of Alberta Curriculum Praxis Occasional Paper.

Bruffee, K. A. (1992). Science in a postmodern world. Change, 24 (5), 18-25.

Bruner, J. S. (1960). The process of education. Cambridge, Mass: Harvard University Press.

Buck, G. H. and Osborne, J. (1990). Progress in education: A deconstructionist view. Journal of Educational Thought, 24 (3), 178-186.

Bump, J. (1985). Metaphor, creativity, and technical writing. College Composition and Communication, 36 (4), 444-453.

Butt, R. & Mokosch, E. (1984). Scientific enlightenment for a technological age. Lethbridge: University of Lethbridge.

Bybee, R. & Mau, T. (1986). Science and technology-related global problems: An international survey of science educators. Journal of research in Science Teaching, 23, 599-618.

Bybee, R. W. (1985). The Sisyphean question in science education: what should the scientifically and technologically literate person know, value, and do- as a citizen? In R. W. Bybee (Ed.) Science, Technology, Society: 1985 yearbook of the National Science Teachers Association (pp. 79-93). Washington, D.C.: National Science Teachers Association.

Bybee, R. W. (1987). Science education and the science-technology-society (S-T-S) theme. Science Education, 71 (5), 667-683.

Bybee, R. W. (1992). Science-technology-society in science curriculum: the policy-practice gap. In M. O. Thirunarayanan (Ed.). Handbook of Science, Technology and Society: Volume 1. A Theoretical and conceptual overview of science, technology and society education (pp. 74-85). Tempe, Arizona: Arizona State University.

Bybee, R.. (1991). Science-technology-society in science curriculum: the policy-practice gap. In M. O. Thirunarayanan (Ed.), Handbook of science, technology, and society: Volume I, A theoretical and conceptual overview of science, technology and society education (pp. 74-85). Tempe, Arizona: Arizona State University.

Byfield, M. (1989, July 11). APEGGA slams science course. Calgary Sun, p. 22.

Byfield, T. (1989a). Here's why Alberta should fire its Minister of Education. Alberta Report, 16 (26), p. 44.

Byfield, T. (1989b, May 28). Cage those education monkeys! Calgary Sun, p. 12.

Byfield, V. & Hutchinson, B. (1989). Doctors let loose a fusillade. Alberta Report, 16 (30), pp. 26-27.

Byfield, V. & Kubish, G. (1990). On senior high science, a compromise. Alberta Report, 17 (5), pp. 1, 26

Byfield, V. & MacDonald, P. (1989a). The death of science. Alberta Report, 16 (26), pp. 23-24.

Byfield, V. & MacDonald, P. (1989b). 'Dumbing down' high schools. Alberta Report, 16 (27), pp. 28-34.

Byfield, V. & MacDonald, P. (1989c). Quelling the science fire. Alberta Report, 16 (33), p 28.

Byfield, V. (1989a). The science fight goes political. Alberta Report, 16 (28), pp. 30-31.

Byfield, V. (1989b). Whom do you trust on Science Ed? Alberta Report, 16 (37), 44.

Campbell, P. (1986). Proposal for change- senior high school science. Edmonton: Alberta Education.

Carroll, P. (1986). Change: Nightmare or euphoric dream? The Ontario Journal of Educational Administration, 1 (3), 19-21.

Carson, T. R. (1986). Closing the gap between research and practice: conversation as a mode of doing research. Phenomenology + Pedagogy, 4 (2), 73-85.

Central Office of Information (1988). Education reforms in Britain. London: Author.

Champagne, A. & Hornig, L. E. (1986). Critical questions and tentative answers for the school science curriculum. In A. Champagne & L. E. Hornig (Eds.), This year in science education 1986: The science curriculum (pp. 1-12). Washington, D.C.: American Association for the Advancement of Science.

Cheney, J. (1989). Postmodern environmental ethics: Ethics as bioregional narrative. Environmental Ethics, 2, Summer, 117-134.

Cherryholmes, C. H. (1985). Theory and Practice: On the role of empirically based theory for critical practice. American Journal of Education, 94 (1), 39-70.

Cherryholmes, C. H. (1987). A social project for curriculum: post-structural perspectives. Journal of Curriculum Studies, 19 (4), 295-316.

Cherryholmes, C. H. (1988a). An exploration of meaning and dialogue between textbooks and teaching. Journal of Curriculum Studies, 20 (1), 1-21.

Cherryholmes, C. H. (1988b). Power and criticism: Poststructural investigations in education. N. Y.: Teachers College Press.

Children 'In a State of Shock' After Seeing Explosion on TV. (1986, January 29). Globe and Mail, p. A14.

Clifford, M. (1989). Postmortem thought and the end of man. In A. B. Dallery & C. E. Scott (Eds.), The question of the other: Essays in contemporary continental philosophy (pp. 213-221). Albany, N.Y.: State University of New York Press.

Cohen, L. (1992). The future. Don Mills, Ontario: Sony Music Canada.

Committee on High-School Biology Education. (1990). Fulfilling the promise: Biology education in the nation's schools. Washington, D.C.: National Academy Press.

Common, D. L. (1981). Two decades of curriculum innovation and so little change. Education Canada, 21 (3), 42-48.

Connelly, F. M. (1987). Ontario science education report card: Canadian national comparisons. Toronto: Ontario Ministry of Education.

Connelly, F. M. and Clandinin, D. J. (1990). Stories of experience and narrative inquiry. Educational Researcher, 19 (4), 2-14.

Connelly, F. M., Crocker, R. K., & Kass, H. (1985). Science education in Canada: Volume 1. Toronto: Ontario Institute for Studies in Education.

Connelly, F. M., Crocker, R. K., & Kass, H. (1989). Science education in Canada: Volume 2. Toronto: Ontario Institute for Studies in Education.

Cox, D. C. (1980). Unified science education and the paradigms of science. Halifax: Atlantic Institute of Education.

Crandall, D. P. (1983). The teacher's role in school improvement. Educational Leadership, 41 (3), 6-9.

Creation House, (1973). New American Standard Bible. Carol Stream, Illinois: Author.

Crichton, M. (1990). Jurassic park. Toronto: Ballantine Books.

Crocker, R. K. (1982). Implementing curriculum change: experience from two science projects. Morning Watch, 9 (3), 28-35.

Crowell, S. (1989). A new way of thinking: The challenge of the future. Educational Leadership, 47 (1), 60-63.

Cuban, L. (1982). Persistent instruction: the high school classroom, 1900-1980. Phi Delta Kappan, 64 (2), 113-118.

Cuban, L. (1984). How teachers taught: Constancy and change in American classrooms 1890-1980. N. Y.: Longman.

Cuban, L. (1990). Reforming again, again, and again. Educational Researcher, 19 (1), 3-13.

cummings, e. e. (1955). Three statements. In G. Geddes (Ed.), 20th Century poetry & poetics (pp. 435-438). Toronto: Oxford University Press.

cummings, e. e. (1962). Pity this busy monster, manunkind. In G. J. Firmage (Ed.), E. E. Cummings: Complete poems, 1904-1962 (p. 554). N.Y.: Liverright.

Cupato, J. D. (1987). Radical hermeneutics: Repetition, deconstruction, and the hermeneutic Project. Bloomington: Indiana University Press.

Curtis, B. (1988). Policing pedagogical space: "Voluntary" school reform and moral regulation. Canadian Journal of Sociology, 13 (3), 283-304.

Da Silva, T. T. (1988). Distribution of school knowledge and social reproduction in a Brazilian urban setting. British Journal of Sociology of Education, 9 (1), 55-79.

Daignault, J. (1992). Serenity. Paper presented at the 1992 Bergamo Conference on Curriculum Theory and Classroom Practice, Dayton, Ohio, October 14-18.

Dalgleish, O. (1957a, October 9). Funds for research. Globe and Mail, p. 6.

Dalgleish, O. (1957b, November 6). Reassessing our values. Globe and Mail, p. 6.

Davey, C. (1957, October 10). Must compete with Soviet: PM. Globe and Mail, p. 1.

De Laeter, J. R. (1989). The influence of American and British though on Australian physics education. Science Education, 73 (4), 445-457.

Deane, P. (1957, October 10). Eisenhower undisturbed by Red satellite; casts doubts on accuracy of Soviet rockets. Globe and Mail, pp. 1-2.

DeBoer, G. E. (1991). A history of ideas in science education: implications for practice. N. Y. : Teachers College Press.

Deleuze, G. (1988). Foucault. (S. Hand, Trans.). Minneapolis: University of Minnesota Press. (Original work published 1986)

deLuna, P. (1989a). Universities place conditions on accepting Science 30. ATA News, 23 (13), 6.

deLuna, P. (1989b). Teachers weigh new science program. ATA News, 23 (13), 6.

deLuna, P. (1989c). Alberta education postpones senior high science program. ATA News, 23 (16), 3.

Derrida, J. (1982). Margins of philosophy. (A. Bass, trans.) Chicago: University of Chicago Press. (Original work published in 1972)

Digeser, P. (1992). The fourth face of power. The Journal of Politics, 54 (2), 977-1007.

Dinning under fire over science course. (1989, June 29). Edmonton Journal, p. B8.

Doll, R. C. (1986). Curriculum improvement: Decision making and process. Toronto: Allyn and Bacon.

Doll, W. E. (1989). Foundations for a post-modern curriculum. Journal of Curriculum Studies, 21 (3), 243-253.

Doll, W. E. (1992). Curriculum possibilities in a "post"-future. Paper presented at the 1992 Bergamo Conference on Curriculum Theory and Classroom Practice, Dayton, Ohio, October 14-18.

Dreyfus, H. L. & Rabinow, P. (1982). Michel Foucault: Beyond structuralism and hermeneutics. Chicago: University of Chicago Press.

Drury, A. (1957, November 8). Eisenhower overhauls science-defense setup. Globe and Mail, pp. 1-2.

DuBois, M. (1991). The governance of the third world: A Foucauldian perspective on power relations in development. Alternatives, 16, 1-30.

Durant, W. (1961). The story of philosophy. Toronto: Washington Square Books.

Duschl, R. A. (1988). Abandoning the scientistic legacy of science education. Science Education, 72 (1), 51-62.

Duschl, R. A. (1990). Restructuring science education. N.Y.: Teachers College Press.

Eamon, J. (1989, September 25). Minister defends science change. Grande Prairie Herald Tribune, p. 3.

Education Manitoba. (1990). Curriculum. Education Manitoba, 18 (1), 29.

Education Nova Scotia. (1990). Curriculum Update. Education Nova Scotia, 21 (1), 7.

Eijkelhof, H. & Lijnse, P. (1988). International Journal of Science Education, 10 (4), 464-474.

Eisner, E. W. (1979). The educational imagination. N.Y.: Macmillan.

Elliot, E. W. and Vallance, E. (1974). Conflicting conceptions of curriculum. Berkeley, California: McCutchan Publishing.

Elliott, O. (1989, February 6). Better science programs a must for schools. The Edmonton Journal, p. C2.

Eribon, D. (1989). Michel Foucault. Paris: Flammarion.

Eribon, D. (1991). Michel Foucault. (B. Wing, Trans.). Cambridge, Mass.: Harvard University Press. (Original work published 1989)

Evans, B. (1987). Agency and structure- influences on a principal's initiation of change in school practices. Australian Journal of Education, 31 (3), 272-283.

Evans, T. P. (1979). Bringing about change in science education. In M. R. Abraham& F. Fox (Eds.), Science Education/Society: A Guide to Interactions and Influence. (pp. 326-337). Columbus, Ohio: ERIC Clearinghouse for Science, Mathematics, and Environmental Education.

Faculty of Science, University of Alberta. (1991). Science 30. Faculty of Science Express, 1 (5), 1.

Farrell, E. J. (1985). Making connections: Academic reform and adolescents' priorities. English Journal, 74 (4), 22-28.

Farrell, W. E. (1969, July 21). The world's cheers for American technology are many. New York Times, p. 10.

Feather, F. G-forces: Reinventing the world. Toronto: Summerhill Press.

Fensham, P. J. (1988a). Physical science, society and technology: A case study in the sociology of knowledge. Australian Journal of Education, 32 (3), 375-386.

Fensham, P. J. (1988b). Approaches to the teaching of STS in science education. International Journal of Science Education, 10 (4), 346-356.

Fensham, P. J. (1993). Academic influence on school science curricula. Journal of Curriculum Studies, 25 (1), 53-64.

Fine, M. (1988). Sexuality, schooling, and adolescent females: The missing discourse of desire. Harvard Educational Review, 58 (1), 29-53.

Fink-Eitel, H. (1992). Foucault: An introduction. (Edward Dixon, Trans.). Philadelphia: Pennbridge Books.

Forbes, S. (1990, February 8). Letter of the day. Edmonton Journal, p. A15.

Foster, W. F. (1990). The protection of subjects of educational research: Is it necessary? Education Canada, 30 (3), 22-26.

Foucault, M. (1969b, April-May). Explique son dernier livre. Magazine Littéraire, 23-25.

Foucault, M. (1971). Orders of discourse. Information Sur Les Sciences Sociales, 10 (2), 7-30.

Foucault, M. (1972). The Archeology of Knowledge. (A.M. Sheridan Smith, Trans.). New York: Pantheon Books. (Original work published in 1969)

Foucault, M. (1973). The Order of Things. N. Y.: Vintage Books. (Original work published in 1966)

Foucault, M. (1977). Pouvoir/Savoir. N. Y.: Pantheon Books.

Foucault, M. (1979). Discipline and punish. (A. Sheridan, Trans.). N.Y.: Vintage Books. (Original work published 1975)

Foucault, M. (1980). Power/Knowledge. (C. Gordon, L. Marshall, J. Mepham & K. Soper, Trans.). New York: Random House. (Original work published 1977)

Foucault, M. (1982). Is it really important to think? (T. Keenan, Trans.). Philosophy & Social Criticism, 9 (1), 31-40.

Foucault, M. (1983). On the genealogy of ethics: An overview of a work in progress. In D. Dreyfus & P. Rabinow (Eds.) (1983). Michel Foucault: Beyond structuralism and hermeneutics (pp. 229-254). Chicago: University of Chicago Press.

Foucault, M. (1984a). The Foucault Reader, (P. Rabinow, Ed.). N.Y.: Pantheon Books.

Foucault, M. (1984b). Truth and power. In P. Rabinow (Ed.), The Foucault Reader (pp. 51-75). N.Y.: Pantheon Books.

Foucault, M. (1984c). Politics and ethics: An interview. In P. Rabinow (Ed.), The Foucault Reader (pp. 373-390). N.Y.: Pantheon Books. (Original work published 1983)

Foucault, M. (1984d). Nietzsche, Genealogy, History. In P. Rabinow (Ed.), The Foucault Reader (pp. 76-100). N.Y.: Pantheon Books. (Original work published 1971)

Foucault, M. (1988). On power. In M. Foucault (Ed.) (1988), (A. Sheridan, Trans.), Politics, philosophy and culture (pp. 96-109). N.Y.: Routledge. (Original work published 1978)

Foucault, M. (1989a). Rituals of exclusion. In S. Lotringer (Ed.), Foucault live (J. Johnson, Trans.) (pp. 63-72). N.Y.: Semiotext(e). (Original work published 1971)

Foucault, M. (1989b). An historian of culture. In S. Lotringer (Ed.), Foucault live (J. Johnson, Trans.) (pp. 73-88). N.Y.: Semiotext(e). (Original work published 1973)

Foucault, M. (1989c). What calls for punishment?. In S. Lotringer (Ed.), Foucault live (J. Johnson, Trans.) (pp. 279-292). N.Y.: Semiotext(e). (Original work published 1983)

Foucault, M. (1989d). Foucault responds to Sartre. In S. Lotringer (Ed.), Foucault live (J. Johnson, Trans.) (pp. 35-43). N.Y.: Semiotext(e). (Original work published 1968)

Foucault, M. (1989e). The archaeology of knowledge. In S. Lotringer (Ed.), Foucault live (J. Johnson, Trans.) (pp. 45-56). N.Y.: Semiotext(e). (Original work published 1969)

Foucault, M. (1989f). The order of things. In S. Lotringer (Ed.), Foucault live (J. Johnson, Trans.) (pp.1-10). N.Y.: Semiotext(e). (Original work published 1966)

Foucault, M. (1989g). The birth of the world. In S. Lotringer (Ed.), Foucault live (J. Johnson, Trans.) (pp. 57-61). N.Y.: Semiotext(e). (Original work published 1969)

Foucault, M. (1989h). How much does it cost for reason to tell the truth. In S. Lotringer (Ed.), Foucault live (J. Johnson, Trans.) (pp. 233-256). N.Y.: Semiotext(e). (Original work published 1983)

Foucault, M. (1989i). How much does it cost for reason to tell the truth. In S. Lotringer (Ed.), Foucault live (J. Johnson, Trans.) (pp. 11-33). N.Y.: Semiotext(e). (Original work published 1967)

Foucault, M. (1990). The history of sexuality. Volume I: An introduction. R. Hurley (Trans.). N.Y.: Vintage Books. (Original work published 1976)

Fowler, R. H. (1990). Politics and ideology in curricular decision-making: the case of British Columbia 1979-1982. Paper presented at the 1990 Conference on Curriuclum Theory and Classroom Practice, Dayton, Ohio, October 17-20.

Franklin, U. (1990). The real world of technology. Toronto: CBC Enterprises.

Fraser, N. & Nicholson, L. J. (1990). Social criticism without philosophy: An encounter between feminism and postmodernism. In L. J. Nicholson (Ed.), Feminism/postmodernism (pp. 19-38). N.Y.: Routledge.

Freedman, J. (1989a). The Science 10 controversy explained. Unpublished manuscript. Red Deer, Alberta: Author.

Freedman, J. (1989b, August 12). The new science courses are pulp. Red Deer Advocate, p. 5A.

Freedman, K. & Popkewitz, T. S. (1988). Art education and social interests in the development of American schooling: Ideological origins of curriculum theory. Journal of Curriculum Studies, 20 (5), 387-405.

Fullan, M. (1977). Research on curriculum and instruction implementation. Review of Educational Research, 47 (1), 335-397.

Fullan, M. (1982). The meaning of educational change. Toronto: OISE Press.

Fullan, M. (1991). The new meaning of educational change. Toronto: OISE Press.

Fullan, M. (1993). Innovation, reform and restructuring strategies. In G. Cawelti (Ed.), Challenges and Achievements in American Education: 1993 Yearbook of the Association of Supervision and Curriculum Development (pp. 116-133). Alexandria, VA: Association of Supervision and Curriculum Development.

Fusfled, H. I. (1979). Overview of science and technology policy- 1979. In H. Fusfeld (Chairman), Annals of the New York Academy of Sciences, Volume 334: Science and technology policy: Perspectives for the 1980s (pp. 1-26). N.Y.: New York Academy of Sciences.

Gagné, R. M. and Briggs, L. J. (1974). Principles of instructional design. Toronto: Holt, Rinehart, and Winston.

Galbraith, B. (1983). Science process skills and the Alberta science curriuclum: A position paper. Edmonton: Alberta Education.

Gane, M. (1986). Introduction: Michel Foucault. In M. Gane (Ed.) (1986), Towards a critique of Foucault (pp. 2-14). N. Y.: Routledge & Kegan Paul.

Gaskell, J. (1980). Woerld trends in science education: A report from Halifax. B.C. Science Teacher, 21 (4), 25-26.

Gay, P. (1988). Freud: A life for our time. N.Y.: W.W. Norton & Co..

Gillan, G. (1987). Foucault's philosophy. Philosophy and Social Criticism, 12 (2-3), 145-155.

Giroux, H. A. (1983). Theory and resistance: A pedagogy for the opposition. South Hadley, Mass.: Bergin and Garvey.

Giroux, H. A. (1985). Teachers as transformative intellectuals. Social Education, 49 (5), 376-379.

Giroux, H. A., Penna, A. N., & Pinar, W. F. (Eds.) (1981). Curriculum and instruction. Berkeley, California: McCutchan.

Giroux, H., Penna, A., & Pinar, W.F. (1981). Introduction and overview to the curriculum field. In H. Giroux, A. Penna, & W. F. Pinar (Eds.), Curriculum and Instruction (pp. 1-9). Berkeley, California: McCutchan.

Goddard, R. (1989). The management of change: Getting started. The Monograph, 40 (2), 14-16.

Good, R., Herron, J., Lawson, A., Renner, J. (1985). The domain of science education. Science Education, 69 (2), 139-141.

Goodwin, I. (1988). Five years after 'A Nation at Risk' US schools still seek better grades. Physics Today, November, 50-52.

Gordon, C (1980). Preface. In M Foucault (1980). Power/Knowledge. (C. Gordon, L. Marshall, J. Mepham, & K. Soper, Trans.) (pp. vii-x). N. Y.: Pantheon Books. (Original work published in 1977)

Government of Alberta. (1984). Proposals for an industrial and science strategy for Albertans- 1985 to 1990. Edmonton: Author.

Government of Alberta. (1985). Secondary education in Alberta. Edmonton: Ministry of Education.

Government of British Columbia (1989). Year 2000: A Curriuclum and Assessment Framework for the Future. Victoria, B.C.: Ministry of Education.

Government of Canada. (1988). Science and technology in Canada. Ottawa: Department of Science and Technology.

Greene, M. (1986). Towards possibility: Expanding the range of literacy. English Education, 18 (4), 231-243.

Greene, M. (1987). Sense-making through story: An autobiographical inquiry. Teaching Education, 1 (2), 9-14.

Greene, M. (1988). The dialectic of freedom. N.Y.: Teachers College.

Gruber, D. F. (1989). Foucault and theory: Genealogical critiques of the subject. In A. B. Dallery & C. E. Scott (Eds.), The question of the other: Essays in contemporary continental philosophy (pp. 189-196). Albany, N.Y.: State University of New York Press.

Gruender, C. D. & Tobin, K. G. (1991). Promise and prospect. Science Education, 75 (1), 1-8.

Grumet, M. R. (1981). Autobiography and reconceptualization. In H. A. Giroux, A. N. Penna, & W. F. Pinar (Eds.), Curriculum and instruction (pp. 139-144). Berkeley California: McCutchan.

Grumet, M. R. (1987). The politics of personal knowledge. Curriculum Inquiry, 17 (3), 317-329.

Grun, B. (1979). The timetables of history. N.Y.: Simon and Schuster.

Grundy, S. (1987). Curriculum: product or praxis? London: Falmer Press.

Guba, E. G. & Lincoln, Y. S. (1982). Effective evaluation. London: Jossey-Bass.

Guha, R. (1989). Radical American environmentalismand wilderness preservation: A third world critique. Environmental Ethics, 2, Summer, 71-83.

Guinness, O. (1979). The dust of death. Downers Grove, Illinois: InterVarsity Press.

Gutting, G. (1989). Michel Foucault's archeology of scientific reason. New York: Cambridge University Press.

Habermas, J. (1982). Knowledge and human interests. (J. Shapiro, Trans.). Beacon Press, Boston. (Original work published in 1968)

Habermas, J. (1992). The philosophical discourse of modernity. (F. G. Lawrence, Trans.). Cambridge, Massachusetts: MIT Press. (Original work published 1985)

Half-Ton Sputnik II Carries Dog, Circles Earth at 1,000-mile Level. (1957, Novemeber 4). Globe and Mail, pp. 1-2.

Hall, G. E. and Loucks, S. F. (1977). A developmental model for determing whether the treatment is actually implemented. American Educational Research Journal, 14 (3), 263-276.

Hansard Education News. (1989). Oral question period, June 13, 1989. Edmonton: Government of Alberta.

Hart, P. (1987). Science for Saskatchewan schools: field study report. Regina: University of Regina Press.

Hart, P. (1989). Toward renewal of science education: A case study of curriculum policy development. Science Education, 73 (5), 607-634.

Harvey, B. (1969, July 21). TV coverage of Apollo 11 linked 500 million in world. Edmonton Journal, p. 9.

Heidegger, M. (1977). The question concerning technology. In D. F. Krell (Ed.) (1977), Marin Heidegger: Basic writings (D. Krell, Trans.) (pp. 287-317). N. Y.: Harper & Row. (Original work published 1954)

Helgeson, S., Blosser, P., & Howe, R. (1977). The status of pre-college science, mathematics, and social science education: 1955-1975: Volume 1 Science Education. Ohio State University: Center for Science and Mathematics Education.

Hellfritz, C. (1990). Dialogue on science education in Alberta. The Pegg, January, 1990, p. 6.

Hershel, A. J. (1955). God in search of man: A philosophy of Judaism. N. Y.: Farrar, Straus, and Giroux.

Hodson, D. (1988). Toward a philosophically more valid science curriculum. Science Education, 72 (1), 19-40.

Hoffer, E. (1951). The true believer. N. Y.: Harper and Row.

Holton, G. (1992). How to think about the 'anti-science' phenomenon. Public Understanding of Science, 1 (1), 103-128.

Hoskin, K. (1990). Foucault under examination: the crypto-educationalist unmasked. In S. J. Ball (Ed.), Foucault and Education: Disciplines and Knowledge (pp. 29-53). New York: Routledge.

House, E. R. (1979). Technology versus craft: a ten year perspective on innovation. Journal of Curriculum Studies, 11 (1), 1-15.

Hug, J. (1985). Michel Foucault: Une histoire de la vérité. Paris: Syros.

Hugo, V. (1887). Les misérables. N.Y.: Thomas Y. Crowell & Co. (Original work published 1862)

Hunkins, F. P. (1980). Curriculum development: Program improvement. Toronto: Charles E. Merrill Publishing.

Hunt, A. (1988). SATIS approaches to STS. International Journal of Science Education, 10 (4), 409-420.

Hurd, P. D. (1961). Biological education in American secondary schools 1890-1960. Washington, D.C.: American Institute of Biological Sciences.

Hurd, P. D. (1964). Toward a theory of science education consistent with modern science. In National Science Teachers Association, Theory into action in science curriculum development (pp. 5-15). Washington, D.C.: National Science Teachers Association.

Hurd, P. D. (1975). Science, technology, and society: New goals for interdisciplinary science teaching. Science Teacher, 42 (2), 27-30.

Hurd, P. D. (1985). A rationale for a science, technology, and society theme in science education. In R. W. Bybee (Ed.) Science, Technology, Society: 1985 yearbook of the National Science Teachers Association (pp. 94-101). Washington, D.C.: National Science Teachers Association.

Hurd, P. D. (1986). Perspectives for the reform of science education. Phi Delta Kappan, 67 (5), 353-358.

Hurd, P. D. (1989). Problems and issues in science-curriculum reform and implementation. In Committee on High-School Biology Education, High-school biology: today and tomorrow (pp. 291-312). Washington, D.C.: National Academy of Sciences.

Hurd, P. D. (1991a). Closing the educational gaps between science, technology, and society. Theory Into Practice, 30 (4), 251-259.

Hurd, P. D. (1991b). Why we must transfrom science education. Educational Leadership, 49 (2), 33-35.

Hurd, P. D. (1992). Closing the educational gaps between science, technology, and society. In M. O. Thirunarayanan (Ed.). Handbook of Science, Technology and Society: Volume 1. A Theoretical and conceptual overview of science, technology and society education (pp. 14-25). Tempe, Arizona: Arizona State University.

Hurd, P. D. (1994). New minds for a new age: Prologue to modernizing the science curriculum. Science Education, 78 (1), 103-116.

Hutcheon, L. (1991). Theories of culture, ethnicity, and postmodernism. Aurora, 15 (1), 15-18.

Hutchins, R. M. (1952). The great conversation. Toronto: Encyclopaedia Britannica.

Huyssen, A. (1990). Mapping the postmodern. In L. J. Michelson (Ed.), Feminism/postmodernism (pp. 234-277). N.Y.: Routledge.

International Council of Associations for Science Education (1992). The status of Science-Technology-Society reforms efforts around the world (R. E. Yager, Ed.) Arlington, Virgina: National Science Teachers Association.

Jacknicke, K. G. & Rowell, P. M. (1987). Alternative orientations for educational research. Alberta Journal of Educational Research, 33 (1), 62-72.

Jacobs, L. (1984). The book of Jewish belief. N.Y.: Behrman House.

Jagodzinski, J. (1989). Postmodernism and art education. Edmonton, Alberta: Janina Baranowska Press.

James, R. K. and Horn, M. T. (1985). Agenda for action: S/T/S implementation. In R. James, (Ed.), Science, technology, society: resources for science education. (pp. 129-143). Columbus, Ohio: ERIC Clearinghouse for Science, Mathematics, and Environmental Education.

Jegede, O. J. (1988). The development of science, technology and society curricula in Nigeria. International Journal of Science Education, 10 (4), 399-408.

Jenkins, E. W. (1992). School science educaiton: towards a reconstruction. Journal of Curriculum Studies, 24 (3), 229-246.

Jenkins, F. (1990). STS science education: Unifying the goals of science Education. Edmonton: Curriculum Support Branch, Alberta Education.

Johnson Says Feat Shows 'We Can Do Anything.' (1969, July 21). New York Times, p. 15.

Johnson, M. (1981). Definitions and models in curriculum theory. In H. A. Giroux, A. N. Penna, & W. F. Pinar (Eds.) (1981), Curriculum and instruction (pp. 69-85). Berkeley, California: McCutchan.

Johnson, N. A. (1987). The pervasive, persuasive power of perceptions. The Alberta Journal of Educational Research, 33 (3), 206-228.

Johnson, P. (1991). The birth of the modern. N.Y.: Harper Collins.

Johnson, W. (1986, January 29). Shuttle disaster unexplained. Globe and Mail, p. A1.

Jones, C & Hutchings, B. (1993, May 8-9). Science's 'nerd' image turns students off. Weekend Australian, pp. 1-2.

Joyce, B. R. & Hersh, R. H. (1983). The structure of school improvement. New York: Longman.

Joyce, B. R. (1969). Alternate models of elementary education. Toronto: Blaisdell Publishing.

Kass, H. & Blades, D. W. (1992). A post-modern perspective on the marginalization of student voices in science education curriculum-discourse. Paper presented at the 1992 Fourth Annual Conference, International Consortium for Research in Science and Mathematics Education, San Juan, Puerto Rico, February 3-4.

Keeves, J. P. & Morgenstern, C. (1992). Attitudes towards science: measures and effects. In J. P. Keeves (Ed.), The IEA study of Science III: Changes in scinece education and achievement, 1970 to 1984 (pp. 122-140). N.Y.: Pergamon.

Keeves, J. P. (1992). Science education: Towards the future. In J. P. Keeves (Ed.), The IEA study of Science III: Changes in scinece education and achievement, 1970 to 1984 (pp. 1-23). N.Y.: Pergamon.

Kennedy, E. (1976). Biomedical science in an expectant society. In Gerald Weissmann (Ed.), The biological revolution (pp. 11-19). N.Y.: Plenum Press.

Kidder, L. H. (1981). Research methods in social relations. N.Y.: Holt, Rinehart and Winston.

Kierkegaard, S. (1983). Repetition. In H. V. Hong & E. H. Hong (Eds. and Trans.), Fear and Trembling/Repetition (pp. 125-232). Princeton, New Jersey: Princeton University Press. (Original work published in 1843)

Kim, Y. (1991). The nihilisitic challenge to curriculum and pedagogy. Unpublished Doctoral dissertation. Edmonton: University of Alberta.

Kline, M. (1970). Genesis. In D. Guthrie & J. A. Motyer (Eds.), The new Bible commentary revised (pp. 79-114). Grand Rapids, Michigan: Wm. B. Eerdmans.

Klopfer, L. E. & Champagne, A. B. (1990). Ghosts of crisis past. Science Education, 74 (2), 133-154.

Kohak, E. (1984). The embers and the stars. Chicago: University of Chicago Press.

Krell, D. F. (1977). General introduction, In Krell, David F. (Ed.), Martin Heidegger: Basic writings (D. Krell, Trans.) (pp. 3-35). N. Y.: Harper & Row.

Krugly-Smolska, E. (1992). Trends in science and mathematics education research in Canada. MSTE News, 2 (1), 2-3.

Kubish, G. & Byfield, V. (1990). On senior high science, a compromise. Alberta Report, 17 (5), 26.

Kurz, D. E. (1983). The use of participant observation in evaluation research. Evaluation and Program Planning, 6, 93-102.

Kurzweil, E. (1983). Michel Foucault and culture. Current Perspectives in Social Theory, 4, 143-179.

Kyle, W. C., Shymansky, J. A., & Alport, J. M. (1982). Alphabet soup science. The Science Teacher, 49 (8), 49-53.

Langford, C. (1989, October 5). Science curriculum weak: Engineers. Fort McMurray Today, p. 1.

Lather, P. (1986). Research as praxis. Harvard Educational Review, 56 (3), 257-257.

Lau, M. (1989, June 23). Science changes worry. Red Deer Advocate, p. 1B.

Layton, D. (1973). Science of the people: The origins of the school science curriculum in England. N.Y.: Science History Publications.

Layton, D. (1984). Interpreters of science: A history of the Association for Science Education. Portsmouth, Great Britain: John Murray.

Layton, D. (in press). STS in the school curriculum: A movement overtaken by history? In G. Aikenhead & J. Solomon (Eds.), STS Education: International perspectives on reform. N.Y.: Teachers College Press.

Levin, D. M. (1988). The opening of vision: Nihilism and the post-modern situation. N.Y.: Routledge.

Levin, D. M. (1989). The listening self. N.Y.: Routledge.

Lewington, J. (1992, January 16). Breathing life into an old subject. Globe and Mail, p. A1 & A4.

Leithwood, K. A. (1986). Planned educational change. Toronto: OISE Press.

Lock, C. R. (1984). Involving students in curriculum development. Clearing House, 57 (4), 261-262.

Lovelock, J. (1991). Healing Gaia. N.Y.: Harmony Books.

Luke, C., De Castell, S. & Luke, A. (1983). Beyond criticism: The authority of the school text. Curriculum Inquiry, 13 (2), 111-127.

Lyotard, J. (1984). The post-modern condition: A report on knowledge (G. Bennington and B. Massumi, Trans.). Minneapolis, Minn: University of Minnesota Press. (Original work published 1979)

MacDonald, J. B. (1988). Theory-practice and the hermeneutic circle. In W. F. Pinar (Ed.) (1988), Contemporary curriculum discourses (pp. 101-113). Scottsdale, Arizona: Grosuch Scarisbrick.

Macdonald, P. (1990). Taking a few steps back. Alberta Report, 17 (10), 32.

MacKeracher, D. (1985). Science education in a changing society. In F. M. Connelly, R. K. Crocker, & H. Kass (Eds.), Science education in Canada, Volume 1: Policies, Practices, & Perceptions (pp. 82-107). Toronto: OISE Press.

Madison, G. B. (1988). The hermeneutics of postmodernity. Indianapolis: Indiana University Press.

Marean, J. H. (1989, September 3). Science literacy won't dilute course. Calgary Herald, p. C5.

Marshall, J. D. (1989). Foucault and education. Australian Journal of Education, 33 (2), 99-113.

Marshall, J. D. (1990). Foucault and educational research. In S. J. Ball (Ed.), Foucault and Education: Disciplines and Knowledge (pp. 11-28). N. Y.: Routledge.

Marshall, S. J. (1962). The improvement of science education and the administrator. In American Association for the Advancement of Science, The new school science (pp. 2-12). Washington, D.C.: American Association for the Advancement of Science.

Matthews, M. R. (1989). A role for history and philosophy in science teaching. Interchange, 20 (2), 3-15.

Matthews, M. R. (1992). History, philosophy and science teaching: The present rapproachment. Science & Education, 1 (1), 11-48.

McFadden, C. P. (1990a). Paradigm shifts: A revolution in science teaching? Crucible, 21 (5), 16-17.

McFadden, C. P. (1990b, June). The Atlantic science education curriculum project: In search of a path to educational reform. Paper presented at the 1990 Annual meeting of the Canadian Association for Curriculum Stuides, University of Victoria, Victoria, B.C.

McFadden, C. P. (1991). Towards an STS school curriculum. Science Education, 75 (4), 457-469.

McGeachy, F. (1989). The death of science in Alberta. The Alberta Science Teacher, 9 (3), 2-3.

McInnes, C. (1989). Nowhere to hide. Networks, 2 (1), 1.

McLaren, D. J. (1990). Preface. In C. Mungall & D. J. McLaren (Eds.), Planet under stress (pp. xiii-xv). Toronto: Oxford University Press.

McNeil, J. D. (1977). Curriculum: A comprehensive introduction. Toronto: Little, Brown, and Co.

Megill, A. (1985). Prophets of extremity: Nietzsche, Heidegger, Foucault, Derrida. Berkeley, California: University of California Press.

Mercer, K. (1990). Welcome to the jungle: Identity and diversity in postmodern politics. In J. Rutherford (Ed.), Identity, community, culture, difference (pp. 43-71). London: Lawrence & Wishart.

Metcalf, L. & Hunt, M. (1970). Relevance and the curriculum. Phi Delta Kappan, 51, March, 358-361.

Miles, M. B. & Huberman, A. M. (1984). Qualitative data analysis. London: Sage Publications.

Miles, M.B. and Huberman, A. M. (1984a). Drawing valid meaning from qualitative data: Toward a shared craft. Educational Researcher, 13 (5), 20-29.

Miller, J. (1993). The passion of Michel Foucault. N.Y.: Simon & Schuster.

Miller, J. P. and Seller, W. (1985). Curriculum: Perpectives and practice. N. Y.: Longman.

Miller, L. J. (1987). Uneasy alliance: women as agents of social control. Canadian Journal of Sociology, 12 (4), 345-361.

Milner, A., Thomson, P. & Worth, C. (1990). Introduction. In A. Milner, P. Thomson & C. Worth (Eds.), Postmodern conditions (pp. ix-xv). N.Y.: Bergamon.

Minister's Advisory Committee on Curriculum and Instruction Review. (1985). School improvement: Building a more effective learning environment. Regina: Saskatchewan Education.

Ministry of Education, New Zealand (1992). Science in the national curriculum (Draft). Wellington: Author.

More Likely to See Red Earth Satellite Than U.S. Versions. (1957, October 5). Globe and Mail, p. 9.

Mueller, G. E. (1969, July 21). In the next decade: A lunar base, space laboratory. New York Times, p. 14

Mulroney Sends Message of Condolence to U.S. (1986, January 29). Globe and Mail, p. A14.

Murphy, P. J. (1986). Managing situations: The politics of curricular change. Comment on Education, 17 (1), 12-18.

Nadeau, R. and Désautels, J. (1984). Epistemology and the teaching of science. Ottawa: Science Council of Canada.

National Science Teachers Association. (1964). Theory into action in science curriculum devleopment. Washington, D.C.: National Science Teachers Association.

Newton, E. (1991). The challenge of change. The Medium, 31 (1), 3-7.

Nicholls, A. & Nicholls, H. (1972). Developing a curriculum: A practical guide. London: George Allen & Unwin.

Nietzsche, F. (1966). Beyond good and evil. (W. Kaufmann, Trans.) N. Y.: Vintage Books. (Original work published in 1886)

Nietzsche, F. (1967). On the genealogy of morals. (W. Kaufmann, Trans.) N. Y.: Vintage Books. (Original work published in 1887)

Nietzsche, F. (1969). Thus spoke Zarathustra. (R. J. Hollingdale, Trans.) London: Penguin Books. (Original work published in 1885)

O'Neil, J. (1992). Science Education: Schools pushed to broaden access, overhaul practice. ASCD Update, September 1992.

O'Toole, T. (1969, July 21). The step that spanned two million years. Vancouver Sun Special Supplement, p. 2.

Oelschlaeger, M. (1991). The idea of wilderness. London: Yale University Press.

Oliva, P. F. (1982). Developing the curriculum. Toronto: Little, Brown & Company.

Olkowski-Laetz, D. (1989). Space, time, and the sublime. In A. B. Dallery & C. E. Scott (Eds.), The question of the other: Essays in contemporary continental philosophy (pp. 174-185). Albany, N.Y.: State University of New York Press.

Ontario Ministry of Education. (1988). Science is happening here. Toronto: Minsitry of Education.

Orpwood, G. & Souque, J. (1984). Science education in Canadian schools: Summary of Background Study 52. Ottawa: Science Council of Canada.

Orpwood, G. & Souque, J. (1984). Science education in Canadian schools: Volume I, Introduction and curriculum analysis. Ottawa: Science Council of Canada.

Orr, D. (1992). Ecological literacy: Education and the transition to a postmodern world. N.Y.: State University of New York Press.

Paden, R. (1984). On the discourse of pornography. Philosophy and Social Criticism, 10 (1), 17-38.

Paden, R. (1986). Locating Foucault- archaeology vrs structuralism. Philosophy and Social Criticism, 11 (2), 19-38.

Palmer, R. (1989a). Who decides what students should learn in school...and how? Edmonton: Alberta Education, Student Programs and Evaluation Division.

Palmer, R. (1989b). High quality science programs for all Albertans. Edmonton: Alberta Education.

Panel on School Science. (1980). The state of school science: A review of the teaching of mathematics, science, and social studies in American schools, and recommendations for improvments. In National Science Foundation, What are the needs in precollege science, mathematics, and social studies education? Views from the field (pp. 79-120). Washinton, D.C.: National Science Foundation.

Panwar, R. (1989, August 12). This is not watered-down science. Red Deer Advocate, p. 5A.

Panwar, R. (1991). Alberta's sneior high science programs. Alberta Science Education Journal, 24 (2), 8-11.

Panzeri, A. (1989, June 28). Health care threatened if science curriculum is diluted, AMA warns. Edmonton Journal, p. D15.

Panzeri, A. (1990a, January 27). Dinning passes science test. Edmonton Journal, p. A8.

Panzeri, A. (1990b, March 12). Pop-science content seen as key to new curriculum. Edmonton Journal, p. B3.

Panzeri, A. (1990c, April 14). Dinning proves deft in throny portfolio. Edmonton Journal, p. G1, G3.

Passmore, J. A. (1975). The revolt against science. In P. L. Gardner (Ed.), The structure of science education (pp. 41-59). N.Y.: Longman.

Patton, M. Q. (1990). Qualitative evaluation and research methods. London: Sage Publications.

Pedersen, J. E. (1992). STS issues in science : A new paradigm. In M. O. Thirunarayanan (Ed.). Handbook of Science, Technology and Society: Volume 1. A Theoretical and conceptual overview of science, technology and society education (pp. 179-184). Tempe, Arizona: Arizona State University.

Phillips, H., Popowich, G., Roberts, D. & Westbury, R. (1984). Integration of technology in the Alberta science curriculum. Unpublished manuscript.

Phillips, R. (1986). Wanted: Science education for the future. Manitoba Teacher, 64 (3), 21-22.

Pinar, W. F. (1988). Autobiography and the architechture of self. Journal of Curriculum Theorizing, 8 (1), 7-35.

Polyani, J. (1988). How discoveries are made. Keynote address to the Science Council of the Alberta Teachers' Association Annual Convention, Banff Alberta.

Popkewitz, T. S. (1988). What's in a research project: Some thoughts on the intersection of history, social structure, and biography. Curriculum Inquiry, 18 (4), 379-400.

Poster, M. (1989). Critical theory and poststructualism. London: Cornell University Press.

Rabinow, P. (1984a). Introduction. In Paul Rabinow (Ed.), The Foucault Reader (pp. 3-29). N.Y.: Pantheon Books.

Rabinow, P. (Ed.) (1984b). The Foucault reader. N.Y.: Pantheon Books.

Rajachman, J. (1985). Michel Foucault: The freedom of philosophy. N. Y.: Columbia University Press.

Ramsey, J. (1993). The science education reform movement: Implications foir social responsibility. Science Education, 77 (2), 235-258.

Reds Say Sputnik II Raised by New Source of Power. (1957, November 5). Globe and Mail, pp. 1-2.

Reid, W. A. & Westbury, I. (1982). Forward. In J. Olson (Ed.), Innovation in gthe science curriculum (pp. 1-2). London: Croom Helm.

Reston, J. (1969, July 21). New dimension added to history by moon landing. New York Times, p. 11.

Rifkin, J. (1983). Algeny. N.Y.: Penguin Books.

Rifkin, J. (1987, April 26). Is Nature Just a Form of Private Property? New York Times, p. 2F.

Roberts, D. A. (1983). Scientific literacy- towards balance in setting goals for school science programs. Ottawa: Science Council of Canada.

Rochlitz, R. (1992). The aethetics of existence: Post-conventional morality and the theory of power in Michel Foucault. In T. Armstrong (Ed. and Trans.) Michel Foucault: Philosopher (pp. 248-259). N.Y.: Routledge, Chapman and Hall.

Rogers, M. (1989, June 29). Science course passes Hatters' test. Medicine Hat News, p. A3.

Rosenau, P. M. (1992). Postmodernism and the social sciences. Princeton, N.J.: Princeton University Press.

Rosenthal, D. B. (1989). Two approaches to science-technology-society (S-T-S) education. Science Education, 73 (4), 581-589.

Ross, E. (1989a, June 28). 'Diluted' science program draws fire. Calgary Herald, p. B6.

Ross, E. (1989b, March 21). Board wants changes delayed. Calgary Herald, p. B3.

Ross, E. (1989c, July 14). Science friction: Proposed curriculum changes under fire. Calgary Herald, p. C8.

Ross, E. (1989d, August 3). Council will evaluate new science courses. Calgary Herald, p. B3.

Ross, E. (1989e, July 28). 'Diluted' science program draws fire. Calgary Herald, pp. F6-F7.

Ross, E. (1990, February 9). Educators fear credit crunch. Calgary Herald, p. A5.

Roth, J. (1992). Of what help is he? A review of *Foucault and Education*. American Educational Research Journal, 29 (4), 683-694.

Rubin, H. J. (1983). Applied social research. Columbus, Ohio: Charles E. Merrill.

Russell, B. (1952). The impact of science on society. London: George Allen & Unwin.

Russia Launches First Satellite. (1957, October 5). Globe and Mail, pp. 1-2.

Ruzic, N. P. (1970). Where the winds sleep. Garden city, N.Y.: Doubleday and Company.

Ryan, B. P. (1989). Schooling for technological change--Two nations once again. Interchange, 20 (3), 17-34.

Ryan, J. (1991). Observing and normalizing: Foucault, discipline, and inequality in schooling. Journal of Educational Thought, 25 (2), 104-119.

Sanders, D. (1981). The first of everything. N.Y.: Delacorte Press.

Sarason, S. B. (1982). The culture of the school and the problem of change. (2nd ed.). Boston: Allyn and Bacon.

Sarason, S. B. (1990). The predictable failure of educational reform. Oxford: Jossey-Bass.

Sartre, J. (1969). The age of reason (E. Sutton, Trans.). London: Heron Books. (Original work published 1945)

Savan, B. (1988). Science under siege. Toronto: CBC Enterprises.

Sawicki, J. (1987). Heidegger and Foucault: escaping technological nihilism. Philosophy and Social Criticism, 13 (2), 155-173.

Schaeffer, F. A. (1968). Escape from reason. London: Inter-Varsity Press.

Schofield, M. (1969). Social research. London: Heinemann.

Schwab, J. J. (1978). Education and the structure of the disciplines. In J. J. Schwab, Science, curriculum, and liberal education (pp. 229-272). Chicago: University of Chicago Press. (Original essay published 1961)

Schwartz, H. (1957, October 9). Soviet science far advanced in many fields. Globe and Mail, p. 6.

Science Council of Canada. (1984a). Summary of Report 36: Science for every student. Hull, Québec: Canadian Government Publishing Centre.

Science Council of Canada. (1984b). Report 36: Science for every student. Hull, Québec: Canadian Government Publishing Centre.

Second Soviet Satellite Predicted. (1957, October 6). Globe and Mail, p. 57.

Senate Special Committee on Science Policy. (1970). A science policy for Canada: Volume 1: A critical review: Past and present. (Maurice Lamontagne, Chairman). Ottawa: Queen's Printer.

Shelley, M. S. (1988). Frankenstein. N.Y.: Dilithium Press. (Original work published in 1831)

Shubert, W. (1993). Curriculum reform. In G. Cawelti (ed.), Challenges and achievements of American education: 1993 Yearbook of the the Association for Supervision and Curriculum Development (pp. 80-115). Alexandria, VA: Association for Supervision and Curriculum Development.

Shulman, L. S. (1981). Disciplines of inquiry in education: An overview. Educational Researcher, 10 (6), 5-23.

Simon, J. L. (1969). Basic research methods in social sciences. N. Y.: Random House.

Simon, P. (1964). The sounds of silence. N.Y.: Paul Simon Music.

Sinai Publishing (1984). The Holy Scriptures. Tel Aviv, Israel: Sinai Publishing.

Slevinsky, K. (1989). Change? Science Council of the Alberta Teachers' Association Bulletin, June, 6-7.

Smart, B. (1985). Michel Foucault. N. Y.: Tavistock.

Smith, B. L. R. (1990). American science policy since World War II. Washington, D.C.: Brookings Institute.

Smith, H. A. (1980). A report on the implications for the science community of three NSF-supported studies of the state of precollege science education. In National Science Foundation, What are the needs in precollege science, mathematics, and social studies education? Views from the field (pp. 55-78). Washington, D.C.: National Science Foundation.

Snaddon, A. (1969, July 22). Moonmen achieve place in history. Edmonton Journal, p. 2.

Solomon, J. (1991). Teaching about the nature of science in the British National Curriculum. Science Education, 75 (1), 95-103.

Solomon, J. (in press). Conflict between mainstream science and STS in science education. In G. Aikenhead & J. Solomon (Eds.), STS Education: International perspectives on reform. N.Y.: Teachers College Press.

Soltis, J. F. (1984). On the nature of educational research. Educational Researcher, 13 (10), 5-10.

Southam Environment Project. (1989, October 7). Our Fragile Future. The Edmonton Journal, Special supplement.

Southam News Service. (1969, July 22). Magnificent, giant leap earns a global salute. Edmonton Journal, p. 29.

Spellmeyer, K. (1989). Foucault and the freshman writer: Considering the self in discourse. College English, 51 (7), 715-729.

Statistics Canada. (1992). Canada Year Book 1992. Ottawa: Author.

Stenhouse, D. (1985). Active philosophy in education and science. London: George Allen & Unwin.

Stevenson, H. A. (1973). Ten years to know-where. In D. Myers, (Ed.) (1973), The failure of educational reform in Canada (pp. 50-59). Toronto: McClelland and Stewart.

Suzuki, D. (1989a). Inventing the future: Reflections on science, technology, and nature. Toronto: Stoddart Publishing.

Suzuki, D. (1989b, December 3). Facing up to our eco-crisis is not 'gloom and doom'. The Edmonton Journal, p. C5.

Suzuki, D. (1992, August 8). 'Beneficial' technology can have negative side. The Star Phoenix, p. D12.

Taba, H. (1962). Curriculum development: Theory and practice. N.Y.: Harcourt, Brace & World.

Tamir, P. (1988). History and philosophy of science and biological education in Israel. Interchange, 20 (2), 95-98.

Tan, S. (1991). The development of secondary school science curriculum in Malaysia. Science Education, 75 (2), 243-250.

Tanner, D. and Tanner, L. N. (1980). Curriculum development: Theory into practice. N. Y.: Macmillan Publishing.

Teachers cautiously approve new science curriculum. (1990, February 12). ATA News, p. 1.

Tenzin Gyatso. (1990). Freedom in exile. N.Y.: Cornelia & Michael Bessie.

Tessmer, M. & Harris, D. (1990). Beyond instructional effectiveness: Key environmental decisions for instructional designers as change agents. Educational Technology 30 (7), 16-21.

Thiele, L. P. (1990). The agony of politics: The Nietzschean roots of Foucault's thought. American Political Science Review, 84 (3), 907-925.

Thomas, J. R. (1989, July 10). City's high school education fails grade. Calgary Herald, p. A6.

Thomas, L. (1980). Late night thoughts on listening to Mahler's Ninth Symphony. London: Bantam Books.

Tomkins, G. S. (1977). Tradition and change in Canadian education: Historical and contemporary perspectives. In H. Stevenson & J. D. Wilson (Eds.), Precepts, policy and process: Perspectives on contemporary Canadian education (pp. 1-20). London, Ontario: Alexander, Blake Associates.

Townsend, R. C. (1990). How can schooling be improved? Orbit, 21 (3), 2-4.

Tri-Partite Committee on Inservice Education. (1980). Inservice education for implementation of new and revised programs. A study commissioned by Alberta Education, Edmonton, Alberta.

Troost, K. M. (1985). Science education in contemporary Japan. In M. S. Klein & F. J. Rutherford (Eds), Science education in global perspective (pp. 13-66). Washington, D.C.: American Association for the Advancement of Science.

Turney, D. (1976). Sisyphus revisited. In O. L. Davis (Ed.), Perspectives on curriculum development: 1776-1976 (pp. 223-239). Washington, D.C.: Association for Supervision and Curriculum Development.

Tyler, R. W. (1949). Basic principles of curriculum and instruction. Chicago: University of Chicago Press.

Tyler, R. W. (1975). Specific approaches to curriculum development. In Giroux, H. A., Penna, A. N., & Pinar, W. F. (Eds.) (1981), Curriculum and Instruction (pp. 17-30). Berkeley, California: McCutchan.

Ungerleider, D. (1986). The organic curriculum. Academic Therapy, 21 (4), 465-471.

United Nations Environment Programme. (1990). The state of the environment, 1990. N.Y.: UNICEF House.

University of Alberta Faculty of Science ad hoc Committee on the Proposed Revisions to the High School Programs. (1989, April). Report on the Proposed Revision to the High School Science Program. Edmonton: University of Alberta Faculty of Science.

Vattimo, G. (1988). The end of modernity. (J. Snyder, Trans.). Baltimore: John Hopkins University Press. (Original work published 1985)

Viall, P. (1962). Preface. In American Association for the Advancement of Science, The new school science (p. i). Washington, D.C.: American Association for the Advancement of Science.

Victor, E. & Kellough, R. D. (1993). Science for the elementary school. N.Y.: Macmillan publishing.

Visvanathan, S. (1987). From the annals of the laboratory state. Alternatives, 12, 37-59.

von Braun, W. (1970). Introduction. In N. P. Ruzic (1970), Where the winds sleep (p. i). Garden city, N.Y.: Doubleday and Company.

Walker, D. (1990). Fundamentals of curriculum. N.Y.: Harcourt, Brace Jovanovich.

Walker, L. (1986). More a torment that a benefit: English grammar in Nova Scotia Schools in the nineteenth century. Curriculum Inquiry, 16 (4), 439-462.

Walsh, A. (1986). The maps are drawn by a living choir: Contexts for the practice of a feminist metatheory of literary history. Interchange, 17 (1), 1-22.

Waring, M. (1979). Social pressures and curriculum innovation: a study of the Nuffield Foundation science teaching project. London: Methuen.

Webster, N. (1986, January 29). That moment in space. Globe and Mail, p. A6.

Wereley, I. (1989). Physics and the new Alberta science curriculum. Alberta Science Teacher, 9 (2), 16-18.

Westbury, I. & Wilkof, N. (1978). Introduction. In J. J. Schwab (1978), Science, curriculum, and liberal education (pp. 1-40). Chicago: University of Chicago Press.

Wilford, J. N. (1971). We reach the moon. N. Y.: W.W. Norton and Company.

Wilford, J. N. (1986, January 29). Faith in technology jolted, but there is no going back. New York Times, p. A7.

Wilson, J. (1991, August 21). Is science falling on deaf ears? Globe and Mail, p. A.16.

Wirth, A. G. (1989). The violation of people at work in schools. Teachers College Record, 90 (4), 535-549.

Wise, A. E. (1977). Why educational policies often fail: The hyperrationalization hypothesis. Curriculum Studies, 9 (1), 43-57.

Wood, E. (1990). Reforming teaching: Is it possible? Education Canada, 30 (4), 28-35.

World Commission on Environment and Development. (1987). From one Earth to one world. In G. Brundtland (Chairman), Our Common Future (pp. 2-23). N.Y.: Oxford University Press.

Yager, R. E. & Penick, J. (1986). What students say about science teaching and science teachers. Science Education, 68 (2), 143-152.

Yager, R. E. & Yager, S. (1985). Changes in perceptions of science for third, seventh, and eleventh grade students. Science Education, 22 (4), 347-358.

Yager, R. E. (1981). What are "the basics" in general biology? The American Biology Teacher, 43 (3), 154-156.

Yager, R. E. (1984). The major crisis in science education. School Science and Mathematics, 84 (3), 189-197.

Yager, R. E. (1992). Forward. In International Council of Associations for Science Education (1992). The status of Science-Technology-Society reforms efforts around the world (R. E. Yager, Ed.) (p. iii). Arlington, Virgina: National Science Teachers Association.

Zais, R. S. (1976a). Curriculum: Principles and foundations. N.Y.: Thomas Y. Crowell.

Zais, R. S. (1976b). Conceptions of curriculum and the curriculum field. In H. A. Giroux, A. Penna & W. F. Pinar (Eds.) (1981), Curriculum and instruction (pp. 31-49). Berkeley California: McCutchan.

Zeidler, D. L. (1984). Moral issues and social policy in science education: Closing the literacy gap. Science Education, 68 (4), 411-419.

Zeitlin, I. V. (1987). Ideology and the development of sociological theory. Englewood Cliffs, New Jersey: Prentice Hall.

Zoller, U. (1992). The technology/education interface: STES education for all. Canadian Journal of Education, 17 (1), 86-91.

Zondervan Bible Publishers (1978). New international version of The Holy Bible. Grand Rapids, Michigan: Author.

Zukav, G. (1979). The dancing Wu Li Masters. N.Y.: Bantam Books.

APPENDIX A
SUMMARY OF TOPICS IN BIOLOGY 10, CHEMISTRY 10, & PHYSICS 10

Biology 10 (Alberta Education, 1984)

Cell biology:
- cell theory, Leeuwenhoek, Hooke
- structure of eukaryote cells, cell organelles, differences between plant and animal cells
- organization of cells into tissues, organs, and systems.

Taxonomy:
- morphological comparisons, basis of groupings
- use of dichotomous keys in classification
- viruses, bacteria, unicellular and colonial eukaryote cells
- fungi, photosynthetic plants: ferns, gymnosperms, angiosperms (structure and function)
- porifera and coelenterata, worms
- mollusks and echinoderms, arthropods
- chordates

Chemistry 10 (Alberta Education, 1977a)

Experimental technique:
- qualitative and quantitative measurement, use of S. I. system, significant figures
- laboratory safety
- the scientific method

Classification of matter:
- chemical and physical properties of matter
- mixtures and pure substances
- metals and non-metals
- ionic or molecular substances

Atomic theory:
- history of atomic theory
- structure of the atom
- use of the periodic table of elements

Chemical reactions:
- IUPAC rules for naming chemical substances and writing formulas for them
- the concept of the "mole"
- balancing chemical equations, stoichiometry
- classifying chemical reactions
- the Law of conservation of mass
- importance of chemical reactions and their effects (environmental, economic, etc.).

Physics 10 (Alberta Education, 1977b)

Physics and the work of physicists:
- physics studies the interactions between matter and energy
- physicists ask questions about nature, historical treatment of these questions form the early Greeks.

Physicists often use mathematics to describe natural phenomenon: the example of motion:
- complexity of motion
- motion in a straight line, distance-time graphs
- uniformly accelerated motion
- acceleration and speed-time graphs
- graphic analysis to describe instantaneous and average speed
- use of algebra describe uniform acceleration

New insights on describing motion from the 16th century:
- the climate of the 16th century
- contributions of Galileo; thought experiments, falling bodies and uniform motion
- the derivation of the d/T^2 for uniform acceleration
- significance of Galileo's work

The importance of direction in describing motion:
- the importance of reference points
- the term velocity, graphic representation of velocity
- use of algebraic equations for scalar motion, vector analysis

The contributions of Newton's descriptions of motion:
- dynamics
- vector addition rule
- Newton's three laws of motion, inertia, mass as a property of matter, differences between mass and weight, unbalanced forces, $F = ma$
- the Newton as a unit of force

APPENDIX B
MICHEL FOUCAULT- A BRIEF BIOGRAPHY

Michel Foucault (1926-1984) was born in Poitiers, France. His early education was through the local state system, later in a Catholic school he received his baccalauréat and, with study at the École Normale Supérieure in Sorbonne, he received his Licence de Philosophie in 1948.

The intellectual climate of post-World War II France was dominated on one hand by the existentialism of Sartre and Camus and the spirit of phenomenology advanced by Merleau-Ponty, and on the other hand the political ascendency of Marxism. Having been a student of the Marxist-structuralist Althusser, and "owing him much" (Foucault, 1989i, p. 14), Foucault was initially attracted to Marxist interpretations of history; Foucault even became a member of the Communist Part of France (PCF) "for a few months" (Foucault, 1989, p. 40). Foucault describes this time in his life as "defined by Husserl in a general way, Sartre more precisely and Merleau-Ponty even more precisely" (P. 42). But Foucault began to experience a growing unease with Marxism for "political, ideological and scientific reasons" (p. 41) which he claims led to a sort of "empty space" (p. 42) in his life.

Foucault decided on a career in psychology. In 1950 he took his Licence de Psychologie and in 1951 split from the PCF. A year later he obtained a diploma in psychopathology, enabling him to research into psychiatric practice and mental illness. Foucault's first publication was a monograph written in 1952 entitled: Maladie Mentale et Personnalité (Mental illness and personality). This work, according to Gutting (1989), already reflects themes to be developed in Foucault's later works and the influence of Heidegger and Merleau-Ponty on Foucault's thinking. During the years 1952-1955 Foucault began to write a philosophy of psychology and conversed with (parlera) the works of Nietzsche (Eribon, 1989). Nietzsche presented Foucault with a new perspective (philosophie nouvelle) which Foucault later described as "bringing up for discussion again the fundamental concepts of knowledge, of morals, and of metaphysics" (Foucault, 1989b, p. 77).

In 1958, Foucault left France to be an assistant at the University of Uppsala in Sweden. During the time Foucault taught and studied in Sweden he observed that despite Sweden's reputation as a freer country than France (i.e. less social restrictions), a certain kind of freedom may have as many restrictive effects as a directly restrictive society. Foucault felt this was a very important experience in shaping his thinking. During his three years at Uppsala Foucault was able to finish and edit his doctoral thesis entitled L'Historie de la Folie (A History of Madness). From Uppsala, Foucault accepted a position as Director of the French Centre in Warsaw, Poland where Foucault was able to experience first hand the impositions of an oppressive society; he could only stay one year. In 1959 Foucault became Director of the French Institute of Hamburg, Germany. While in Germany, Foucault became acquainted with the social-critical theorists of the Frankfurt School[1] which, according to Poster (1989), was influential in Foucault's later works.

By 1961 Foucault had returned to France as an associate with the University of Clermont-Ferrand. That same year, Foucault submitted his thesis for the degree of Doctor of Letters: Historie de la Folie à L'Âge Classique (Published in English under the title Madness and Civilization). In his thesis Foucault proposes that a historicity of madness can be approached as a study of the relationship between power and knowledge. He continued his study of the power-knowledge relationship after his appointment as professor of philosophy at the University of Clermont-Ferrand.

Over the next two decades Foucault entered the intellectual discourse of France (and in the late sixties, other nations as well) with the publication of many articles, interviews, essays, and major books. In 1968 Foucault accepted an appointment to the chair of philosophy at the the prestigious Collège de France in Paris. Key works published by Foucault prior to 1968 include: Naissance de la Clinique: Une Archaeologie du Regard Médical (Birth of the Clinic: An Archaeology of Medical Perception), 1963 and Les Mots et Les Choses (Released in English with Foucault's choice of titles: The Order of Things), 1966. In both works, Foucault adapts Nietzsche's notion of 'a genealogy of ideas' into an 'archeology' of the development of scientific knowledge and power; first in the medical field of psychopathology and later in the "established order of things" (Foucault, 1973/1966, p. xix) in present discourses of science.

---

[1] The Frankfurt School refers to a particular group of social critical theorists such as Marcuse, Adorno, and Habermas who at some point have been associated with the Institute for Social Research, founded in Frankfurt, Germany in 1923. Giroux (1983) identifies some distinctive common themes and contributions of these theorists:

A. Critical view of the inheritance of rationality from the Enlightenment.
B. Complete rejection of the usefulness of positivism in the social sciences.
C. Development of a notion of theory as dynamic and subjective, developed through dialectical criticism.
D. Redefinition of culture as essentially political, dynamically open to domination by objectification through the hegemonic ideology of capitalism.
E. Interest in the contributions of Depth Psychology (especially in the work of Freud and the interpretations of Marcuse) to understanding dialectical processes.

The political events of 1968[1] in France led to a shift in Foucault's thinking. He began to believe in a more concretely political role for intellectuals. Considering his earlier works as "a very imperfect sketch" of how power/knowledge is "structured in discursive formation bound to fundamental epistemes" (1973/1966, p.16), Foucault claims these works were written in a "happy state of semi-consciousness, with a great deal of naiveté and a little innocence" (Foucault, 1989g, p. 57). Foucault felt his works prior to 1968 were not entirely clear; his attempts to clarify his thinking and correct what he calls "inaccuracies and carelessness contained in previous books" led to the publication of L'Archéologie du Savoir (The Archeology of Knowledge) in 1969. This work represents a maturing of Foucault's understanding of the relationship between power/knowledge and discursive practice and lays out a research approach which Foucault would follow in his later studies: Of prisons, Surveiller et Punir- Naissance de la Prison (Discipline and Punishment- The Birth of the Prison), 1975; and Foucault's comprehensive study of the history of sexuality, Historie de la Sexualité I: La Volanté de Savoir (History of Sexuality I: The Turn of Knowledge), 1976; Historie de la Sexualité II: L'Usage des Plaisirs (History of Sexuality II: The Use of Pleasure), 1984; Foucault was working on a third volume of the History of Sexuality, Le Souci de Soi (Concern for the Self) when he died from septicemia leading to a brain infection (supperation cérébrale) on the 25th of June, 1984 (Eribon, 1989, p. 350).

For further information on the life of Michael Foucault see Hug (1985) Eribon (1989, 1990) and Miller (1993).

---

[1] Such as the Paris student revolts of May, 1968, the assassination of Robert Kennedy and Martin Luther King, Jr. in the United States, and the Russian invasion of Czechoslovakia.

APPENDIX C
LETTER OF PERMISSION FROM THE MINISTER OF EDUCATION OF ALBERTA

Please see the page that follows.

EDUCATION Office of the Minister

402 Legislature Building, Edmonton, Alberta, Canada T5K 2B6 403/427-2025 Fax 403/428-0788

July 25, 1990

Mr. David W. Blades
Department of Secondary Education
341 Education South
University of Alberta
Edmonton, Alberta
T6G 2G5

Dear Mr. Blades:

Many thanks for sending me your research proposal on changes in high school science programs.

Departmental staff would be pleased to share information that would help you in completing your study. Dr. Morris Treasure in the Curriculum Branch has the major responsibility for the senior high science programs. He can be reached at the following address:

Dr. Morris Treasure
Assistant Director, Secondary
Mathematics and Science
Alberta Education
Curriculum Branch
Devonian Building, West
11160 Jasper Avenue
Edmonton, Alberta
T5K 0L2

Tel: (403) 427-2984

We would also be very interested in the results of your study, and expect that you'll pass along your findings.

I wish you every success in your endeavour to look at change in science curricula.

Yours sincerely,

Jim Dinning
Minister of Education

APPENDIX D
SPECIFIC INTERPRETATION QUESTIONS USED IN RE-SEARCHING PROCEDURES OF POWER IN A CURRICULUM DISCOURSE

1. How does this system of curriculum-discourse present an effective system of exclusion?

A. What limits are imposed on what can be said?

- You cannot just say anything. What is said? What is concealed? What process determines how things are to be done and thus permits what can be said? What approaches exist? What aspects of the discourse fell into oblivion, what did not? What must be enunciated? What is forbidden?
- You cannot just speak of anything where or when we like: How is what's allowed to be said determined in location and time through the movement of people and their placement?
- Not just anyone can speak on anything. What constructions of social relations: hierarchical, relationships, labels, etc. legitimize who may speak? What are the effects- according to who is speaking, their position of power, the institutional context, etc.

B. How does this system render participants neutral, safe, socially and politically sterile?

- How do rituals of exclusion result in "absorbency"- so that the participants become power even as power acts on them?
- How are people moved (and move themselves) from the "radical" to the "normal"?

2. How is division and rejection used in the discourse? Who is suppressed? Repressed?

A. How was division and rejection maintained as a procedure:

- By locating: movement of people, placement
- Through a process: how things are to be done, i.e. approach
- By the construction of social relations: hierarchies, relationships, labels, etc.

B. How was discourse institutionalized? e.g. the Minister's committee, the use of student committees for curriculum design- in a sense this co-opts students into a view of curriculum which has not changed- seeking their approval instead of their criticism. How did this work with the public outcry on the new science programmes?

3. How is a sense of "true" and "false" part of discourse dynamics?

A. What major narratives exist (as "truth" statements?) What is the functioning of these narratives?

- How did procedures of exclusion identify "true" or "false" about the new science programmes?
- What institutional support was there for these truths?
- How did these truths or narratives change in content but not in purpose?
- How did these truths support procedures which put pressure on other types of discourse as "truth" became a vision which excluded other ways of knowing or even seeing.

- How did the establishment and promotion of "truth" justify taboos, rituals of exclusion and definitions of discourse (what may be said, who may say it)?

B. How were "truths" maintained in this discourse...
  - By locating: movement of people, their placement, etc.?
  - Through process: how things are to be done, i.e. approach, etc.?
  - By the construction of social relations: hierarchies, relationships, labels, etc.?

4. In a specific type of discourse on science curriculum, what are the most immediate, most local power relations at work?

Points on power to consider:
1. Power is not an institution, or a structure, or a certain strength we can posses- it is the complex strategies institutionalized or crystallized as laws or hegemonies of a particular part of society.
2. Relations of power are not external to other relations, they are inseparable. Power relations are the immediate effects of divisions, rituals of exclusions, inequalities, etc. of other relations; indeed, power provides the conditions of these differentiations. Power arises from the multiplicity of formed relations immanent in a sphere of operation, able to constitute there own organization
3. Power is not located above or below, but is part of the general matrix of a discourse-practices or procedures. The rulers and ruled are caught equally. Power is maintained and produced through institutions, e.g. family structure, educations system, etc. which sustains the hegemonic effects of power. These institutions support force relations which arise from the formation of a system.
4. Power relations are intentional and non-subjective. These relations are exercised only from a series of aims, objectives, and strategies through "an implicit characteristic of the great anonymous." Power results from procedures which strengthen and reverse force relations via struggles, confrontations, transformations, etc.
5. There is always resistance to power. Conflict and resistance, disjunctions and contradictions which isolate force relations play a role as adversary, target, support etc. in power relations.

Questions:

A. With a specific extortion of truth, appearing historically and in locations (around the child at school, in offices at AbEd, in Universities) what forms of knowledge/power exist? What was legitimized as an area of investigation as a possible object? If power "targeted" this area, it was only because techniques of knowledge and procedures of discourse were capable of investing it. So...we examine local centres of power/knowledge which are common, repeated scenes of power/knowledge, e.g. confessional, scientific study of intercourse, etc.
  - How did these power relations make the discourse possible? How did power relations modify the discourse by strengthening some "terms" and weakening others?
  - How did the discourse make the power relations possible? In discourses, power and knowledge join together, thus discourse = power.

  - -What reciprocal effects of power/knowledge does this discourse ensure?
  - -What conjunction and force relations made this discourse necessary at this point?
  - -What were the effects of resistance and counter-investments?

B. How does the transmission of knowledge play a role in power?

  - -What logic links power relations forming a great strategy which takes the form of a "great unity, voluntary action"?

C. How does power exist as "matrices of transformations"- shifting, mutable, plastic? How are these matrixes both local and general? While explicit in tactic, or at least logical, there is not consciousness nor local origin giving rise to the general.

APPENDIX E
GENERAL MAP OF THE KINGDOM